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Concerning Write-Ups.

One of the worst features of trade journalism is the "write-up" of standard manufactured products. These trade puffs have kept the tone of class papers down at an unnecessarily low level and have weakened the influence of publications which should carry great weight. The belief that publicity can be obtained for payment in the reading pages of such a journal is probably the worst feeling possible to arouse among subscribers. It is naturally a somewhat delicate subject to discuss without reflecting on the management of other publications, and for this reason attention is called to the following statement by one outside the editorial chair, Mr. Arthur Warren, manager of publicity for the Allis-Chalmers Co., whose views on this and other allied topics were expressed at a recent meting of the American Trade Press Association:

"There is one nuisance that we all know about, and that is the 'write-up.' It is a nuisance to you; it is a nuisance to us. But there is a vast difference between the 'write-up,' dreary, fruitless and undisguised, and the timely article that has new value or interest for the commercial world, the factory, the mill, the executive, the artisan, the engineer, the miner, the financier, or the operative. These articles are legitimate if they are well written and informing. A good deal depends on that. The custom has grown up for manufacturers to supply articles to the trade and technical press. If these articles are not always well written, it is because of the difficulty we all experience, manufacturers as well as editors and publishers, in finding the men who can write well. On the other hand, if editors complain because they do not receive articles of sufficient merit, the owners of the papers must in some part blame themselves. The trade and technical press has added a new problem to the many problems of the manufacturer. I would hesitate to tell you how many requests a great engineering concern receives for articles to be written by its engineers who are experts in their respective specialties. You might think the mere figures an exaggeration. But the fact is that if all these requests were complied with the engineers would have little time left for engineering. And, after all, designing and constructing and installing, to say nothing of selling, are what their employers pay them for. If the requests of the press are to be complied with, the manufacturers must employ a staff of writing engineers. This, however, would seem to be the proper function of the press itself."

A fairer statement of the situation than this cannot be made. Some of the most important information to the engineering public, to take a single class of subscribers to specialized publications, comes from manufacturing corporations, and a large amount of information of considerable technical and news value must come from the same source. These corporations are bringing out new devices which the progressive engineer wishes to know about at the earliest possible date. The engineers of these corporations are devising new methods of conducting their work and are making new discoveries of a scientific nature which are legitimate subjects for discussion in an enterprising publication conducted with editorial independence. The subscriber who believes that such articles are inserted in the reading pages for any other reason than because of their actual value is mistaken; fortunately, there are very few subscribers so mentally suspicious as to be unable to appreciate the truth of these statements.

In contrast to this side of the question is that presented by the "write-ups" prepared by the average advertising agent. It is a worthless hash of notes dashed off by the manufacturer for the agent's representative, who then compiles them with the same literary grace and accuracy of statement that he employed the day before for the tooth powder and whisky maker. How any manufacturer can believe that a man without any knowledge of his product, or the class of people by whom it is used, is competent to prepare articles for the class publications reaching his trade, passes comprehension. Nothing is more absurd than the claim that a little two-inch card inserted twice a year in the advertising columns of a respectable journal thereby gives the advertising agent and his client a strangle-hold on half a column in the reading pages every week. Yet that is the foolish story that some manufacturers are induced to believe, because there are, sorry to say, some hangers-on in the journalistic field who will sell space in their reading columns.

If the manufacturer has anything new to introduce, let him tell the editors of the interested publications about it directly. But if the novelty consists of a change in the color of the paint on his tools, then news of that improvement will not enter into any responsible publication, even if the vaunted jimmy of an advertising agent is engaged to do the job.

Municipal Lighting Plants.

The necessarily high cost of electric lighting in large cities has led some mistaken enthusiasts to believe that municipal plants can furnish public lights at a much lower price than the charge for them which is made by private corporations. In the discussion of this subject there is always a conflict of opinion between the advocates of the two systems of operation, public and private, concerning the inclusion or omission of certain large sums in the balance sheets showing relative standing of the systems. For example, the advocates of municipal ownership insist that the cost of running will be reduced because the municipal plant will pay no taxes. This is true. But it does not take into account the fact that while the lighting department of the city government will be credited with a saving of this sum, the tax department will be charged with it, and the taxpayer does not care how such charges and debits are shifted back and forth between the different departments so long as his annual taxes are the same or higher.

Frequently cities do not carry an insurance on their public buildings, and this is put forth as a saving to be credited to municipal ownership, although it would seem to the business man to be a mark of poor judgment. Still another difference of opinion arises in regard to the charges for depreciation and sinking fund. Of late there have been a number of cases of practical breaking down of municipal ownership through a failure to consider these items. It is true that a private company ought to put aside enough money to renew as well as keep in repair its plants, while a city is generally justified in raising the money for renewals by bond issue or some other means which will put the expense of the plant at any time on those who are enjoying its advantages. It is hardly just for the present generation to pay to the city for lighting service sums which are not only sufficient to keep the plant in condition during their lifetime, but are also large enough to provide a plant new in all its essential features for the service of the succeeding generation. A private company, to which people have entrusted the work of lighting, must make some such provision in its schedule of rates or it cannot carry out its trust properly.

The great difficulty with municipal ownership in a large city, which counterbalances all theoretical advantages, comes through the impracticability of managing the affairs of a city lighting plant with the same economy that rules in a plant under private ownership. Without arguing this matter on the basis of existing municipal lighting plants, of which there are very few of large size in this country, it is only necessary to refer to the municipal management of water pumping stations. Probably the most economically managed stations of this type in the country are those under the control of the Metropolitan Water and Sewage Board of Massachusetts, which is free from political pulls. These stations are now pumping water at a lower cost than they did under their former municipal ownership because the operating staff is on a business basis. It is understood that the showing of the municipal station in Baltimore is a fine one. On the other hand, the cost of pumping in other large cities is generally very high, and the management of the plants is not satisfactory. Whether this is because the departments are not given enough men and money to keep the stations in condition, or because they are filled with incompetent men is not to the point. Take the situation in New York a few years ago as an example. Some of the plants were positively unsafe, others were out of repairs, there was no system of accounts by which the operation could be critically watched, and some of the stations were in charge of incompetent men kept in place by politics. This order of affairs was changed while Mr. Nicholas Hill, Jr., was in charge of the water department's engineering works, but the good he accomplished during his too brief tenure of office is fast becoming lost to sight, though dear to memory. It is necessary to-day to look principally to privately owned waterworks, like those of the American Water-Works & Guarantee Co., or the Indianapolis Water Co., for the best pumping practice at the present time, and it is for this reason that it seems hardly desirable to estimate the operating figure of municipally owned lighting plants on the same low plane as those of well-managed private electric companies. Hence the saving due to lack of provisions for renewals of municipal plants will be more than overcome by the losses due to their uneconomical operation.

The New York Additional Water Supply Subject.

This week has been marked by some very frank statements at Albany concerning provisions for building additional works for the water supply of New York City, supplementing those in the Croton basin. Mayor McClellan made on Tuesday a very forceful plea before a joint legislative committee for authority to construct these works at once. "New York wants water," he said, "it wants water as never before. All we ask of you is to give us legislation that will let us go ahead in a businesslike way, without the interference of politics, without changing the three ideas underlying the (Mayor's) bill, those of non-partisanship, home rule and speed. Take this bill and change it as you will, but give us something to meet the emergency, something that will let us go ahead this spring. Enough time has been wasted; to waste more would be a crime." These statements are none too strong. If the City of New York is to have enough water for its needs five years hence, additional works must be started at once. A year more spent in additional committee work cannot be thought of with calmness by those who appreciate the great danger of a water scarcity which is imminent. It is no wonder that Mayor McClellan was followed by his political opponent, ex-Mayor Low, with an equally strong plea for immediate action, for Mr. Low showed his appreciation of the gravity of the situation by having the Burr-Freeman-Hering commission appointed in 1902.

There is, however, another side of this matter which is continually being overlooked by most people. It was first stated publicly by ex-Governor Odell and was repeated on Monday with additional emphasis by Governor Higgins in a special message to the legislature, in which he said: "Under the existing law the Commissioner of Water Supply is authorized to select and condemn sources of water supply throughout the State, subject only to the restriction that he shall not take from another municipality its water supply in actual use or waters which may reasonably become necessary for such supply, or interfere with the canals of the State. The Commissioner may, therefore, take water rights anywhere in the State, subject only to the approval of the Board of Estimate and Apportionment and the Board of Aldermen and the restrictions above referred to. Other municipalities are not in a position before the court to protect their respective needs. In condemnation proceedings under this section of the city charter, compensation is paid only for the value of the property actually taken. Collateral and consequential damages are not considered. With the taking and destruction of the factory on the water-shed, the store may lose its customers, the church its worshippers, and the village its population; values may thus be depreciated without compensation where there is no actual taking of property by the city. The local opposition to the extension of the city's water system into a community is therefore natural and not unjustifiable, and has resulted in special legislation excluding the City of New York from various convenient sources of supply which might be used under proper restrictions."

It is safe to say that the city has little chance of securing the permission it desires without conceding to the opinions expressed by Messrs. Odell and Higgins. The legislature is always willing to help the city whenever it is certain that the interests of the country districts will not be seriously hazarded by doing so. In this case the administration takes the position that the city must agree to the same rules for compensation which are in force in the district where the Metropolitan Water Board of Massachusetts is operating, or it must get its water supply from some other source than that recommended by the Burr-Freeman-Hering commission. It is perfectly true that the payment of collateral and consequential damages due to the taking of large volumes of water will probably be very great, but the city has dallied so long with this question that it must suffer the results of its shiftlessness.

It is important to recall, however, that even in case the city and the State are unable to agree concerning the matter of damages, and the city is kept out of Ulster as well as Duchess county, it is still in a position to secure an ample supply of good water. This can be obtained by filtering Hudson River water obtained near Hyde Park, and building regulating reservoirs in the Adirondacks, so as to keep enough water in the river at all times to prevent any brackish supply entering the intake. This plan was recommended by the engineers of the Merchants' Association's commission, and is stated to be practicable by the Burr-Freeman-Hering Commission. On this account it will not necessarily follow that the legislature condemns New York City to thirst if it rejects any appeal for the right to appropriate large water supplies without provision for all indirect as well as direct damages incident to that act.

Tests of Steam Condensers.

In the accompanying table are given the results of some tests of condensers in electric generating stations in England. The figures are taken from a paper on condensing arrangements in central stations read by Mr. John D. Bailie before the Leeds local section of the Institution of Electrical Engineers on Jan. 19. Generally speaking the author contends that the maintenance of high vacua does not involve the use of abnormal quantities of cooling water and cooling surface, or of abnormally large capacity air pumps, making the equipment one with prohibitive initial and working costs. He presupposes, of course, properly designed condensing outfits and cooling water at a moderate temperature.

The author's chief object in calling attention to the test records tabulated is to emphasize the small percentage of the total power generated that was used in driving the condenser pumps, which in all cases were driven by electric motors. In the case of the Hulton colliery plant, an ejector condenser was used, and it will be seen that the percentage of power used by the motor-driven centrifugal circulating pump was somewhat high, owing chiefly, the author says, to the large quantity of water passing, and to the considerable head against which the pump had to work. The other three cases cited include two with surface condensers and one with a jet condenser with wet and dry pumps. The tube areas of the surface condensers are on the basis of 1 sq. ft. per 10 lb. of steam to be condensed, which is more or less usual practice. The vacuum maintained is higher in the case of West Bromwich, owing in part to the lower temperature of the injection water, and to the greater quantity circulated per pound of steam. The percentage of power used by the pumps is rather lower at West Bromwich because, as explained by the author, of the smaller head against which the pumps work, and to the runners of the Neepsend pumps not being the most suitable for their duty. In the case of Manchester, the vacuum is not so high as at West Bromwich and Neepsend, but this is more than accounted for, in the author's opinion, by the high temperature of the injection water and by the barometer being slightly lower. There is a considerable head against the pumps, and, taking everything into consideration, the result he considers a very good one, although it could be greatly improved by the addition of a vacuum augmentor.

Test of Steam Condensers.

	Station,			
	Hulton.	Neepsend.	W. Bromwich.	Manchester.
Condenser type	Ejector.	Surface.	Surface.	Jet.
Cooling water °F.	67.6	65.3	51	82,
Vacuum, in.	26.17	27.7	28.2	26.66
Barometer, in.	30.05	29.9	29.8	29.5
Steam condensed per hr., lb.	6,996	29,530	10,000	35,700
Cooling water per lb. steam, lb.	68.75	30	50	.....
Power used by pumps, kw.	22.5	37.4	9.17	40
Per ct. total power	7.1	2.3	2.05	2.2
Head against circ. pump, ft.	47.5	20	15	40

Power to Drive Wood-Working Tools.

Some interesting data on electric driving in wood-working shops were recently obtained in two installations in London equipped by Electro-motors, Ltd. Both were the establishments of builders and contractors, the first, Messrs. W. H. Archer & Son, of Gravesend, and the other Messrs. Styles & Sons, Golden Square. The first plant was supplied with compound-wound motors at 460 volts, with Sturtevant starting rheostats, and the second with shunt-wound motors at 214 volts with Ward-Leonard motor starters. The records of the tests were reported in "The Electrician," of London.

A circular saw, in the first plant, driven at about 1,000 r.p.m. by a 12-h.-p. motor, took a 10-in. cut at the rate of 6 ft. per minute on 10x7-in. damp pitch pine, requiring 13.8 h.-p. A tenoning machine driven at 2,700 r.p.m. by a link belt from a 5-h.-p. motor, took 5.5 amperes running light and 9.5 amperes when tenoning pitch pine, removing 3½ cu. in. of wood in 10 seconds. A planer designed for 8x24-in. planks and driven from a 5-h.-p. motor took 5.5 amperes in making a ⅛-in. under cut in pitch pine 9 in. wide, finishing a plank 8.5 ft. long in 25 seconds. A ¼-in. over cut from a plank of pitch pine 5 in. wide took 5.2 amperes in finishing a 6-ft. length in 20 seconds. A band saw traveling at a speed of 4,800 ft. per minute required 2.4 amperes when the motor was driving the belts only, and 3.5 amperes when driving the belt and band saw running light. An emery wheel used for grinding tools and belt-driven at 1,640 r.p.m. by a ½-h.-p. motor required 0.7 am-pere when the outfit was running light; when grinding a straight moulding cutter the current ranged from 1 to 2 amperes.

In the second plant a band saw driven by a 3.5-h.-p. motor at a speed of 3,600 ft. per minute took 4.5 amperes when running light. When making a 6-in. cut in deal wood 9 amperes were taken and 2 ft. were sawed in 25 sec.; with a 2-in. cut in mahogany, 7.5 amperes were taken and 1 ft. was sawed in 4 sec.; with a 4¾-in. cut in oak, 10.5 amperes were taken and 1.5 ft. were sawed in 15 sec.; with a 2¾-in. cut in beech, 10 amperes were taken when 1 ft. was sawed in 15 sec. A 19-in. circular saw driven by a 7-h.-p. motor at 1,050 r.p.m., required 7.5 amperes when running light. With deal wood the following figures were obtained: Two-in. cut, 6-ft. 2-in. length, 17.5 amperes, 10 sec.; 1¼-in. cut, 4-ft. 2-in. length, 14 amperes, 5 sec.; 1¼-in. cut, 7-ft. 3-in. length, 15 amperes, 8 sec.; 6-in. cut, 2-ft. length, 18 amperes, 20 sec. A planer, designed for 20x8-in. planks and driven by a 5-h.-p. motor, took 15 amperes when making a 3/16-in. cut from a 9-in. wide deal plank, requiring 45 sec. for a length of 7 ft. 2 in.; it took 16 amperes when making a 3/32-in. cut from an 18-in. deal plank, cutting 3 ft. 8 in. in 17 sec. A 6-in. emery wheel grinder driven at 1,860 r.p.m. from a 2½-h.-p. motor took 2.5 amperes with motor and belts only, 4.5 amperes with the emery wheel light, and 5.5 amperes with the emery wheel grinding a moulding cutter.

Tests of the general nature of those summarized in the foregoing résumé are coming to light with a gratifying frequency. They are, of course, a result of the introduction of electric power driving, which makes them possible. It has been a matter of considerable trouble and expense, if, indeed, not sometimes impracticable, to determine with any degree of approximation the power consumption of particular machines. Now, with the portable indicating instruments and the electric motor, exact values are obtainable over a varied range of conditions, and it is no longer becoming necessary to rely on the data of the tool-builder, who had not always collected definite information of this character for himself.

Notes and Comments.

The Navy Yard Power Plants are to be consolidated and placed under the management of the Bureau of Yards and Docks. This consolidation was recommended by Messrs. Stone & Webster in a report reviewed in this paper on Dec. 17, 1904, and Secretary Morton's decision to follow this advice will remove one of those absurd conditions which tempt the civilian critic to whistle airs from "Pinafore" while walking through a navy yard.

The Installation of Meters in the waterworks system of Saratoga Springs, N. Y., has resulted in reducing the consumption from a range of 225 gal. per capita per day in the spring and fall and 400 gal. per capita in the winter months, to about 110 gal. in the months of normal temperature and 130 gal. in the winter, according to Mr. J. S. Mott, city engineer. The cost of about 3,000 meters and their installation was approximately $26,000, which was borne by the city. All repairs are made and replacing is done at the expense of the consumer.

An Unusual Reservoir Accident occurred recently in Fort Wayne, Ind. The reservoir is a 3,600,000-gal. basin about 30 ft. deep. It is lined with two courses of brick in Portland cement mortar ,and its inner slopes are 1:1¼. It had not been emptied for about eight years, but was known to have several cracks n the lining. On Feb. 4 there was a very severe fire in the city, during which seven engines were running, two or three of them for over twelve hours. The next morning a hydrant was found broken, and it is asserted that in fixing it a valve was left open, allowing the contents of the reservoir to run to waste. Whatever the cause may have been, the reservoir became empty, and on the morning of Feb. 6 the slopes had caved in.

A State Engineer is required in Arkansas, at least a bill has been introduced in the legislature for the purpose of creating this office. It is to be hoped that should this find favor, some expert assistance will be procured to assist in defining the duties of the office and fixing the appropriations. Ordinarily too little attention is paid to these matters, and impossible tasks and inadequate appropriations are attached to the office.

The Boiler House of the stove manufactory of the McClave Manufacturing Corporation, London, Ont., contains three 100-h.p. Scotch boilers with under-feed mechanical stokers, a 160-tube Green economizer having 1,920 sq. ft. of heating surface, and both forced and induced draft, the former being supplied by a 30-in. fan at 2 oz. pressure, driven by a 6x6-in. engine, and the latter by an 8-ft. fan driven by a 4½x5-in. vertical engine.

The Surface Condenser invented by Ljungstrom was described recently in a paper by Mr. William E. Storey read before the Society of Engineers, of London. Thin brass corrugated plates are employed, with the corrugations at an angle of 45 deg., and the plates are piled together so that adjacent corrugations run in reverse directions. It appears that the plates are in this way mutually supported against atmospheric pressure and that the arrangement of corrugations causes the streams of steam and water to be broken up. It is claimed to be capable of condensing 70 lb. of steam per square foot per hour.

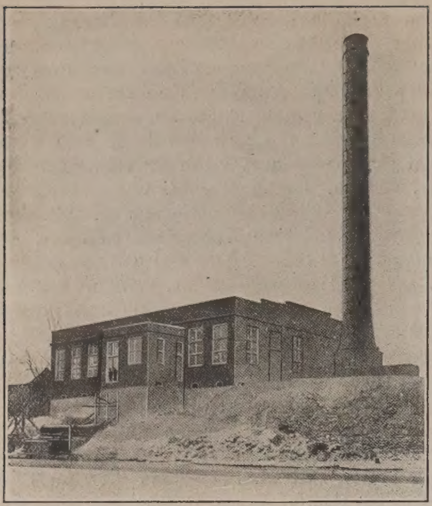
Interstate Water Rights will be put on a definite basis in New Jersey if the Legislature of that State passes a bill introduced on Feb. 20 prohibiting any fresh water to be taken from the State through pipes, conduits, ditches or canals. The immediate object of the bill is understood to be the prevention of the sale of water by the East Jersey Water Co. for use on Staten Island, but it is in keeping with the very jealous care of the Jersey drainage basins which the State has always manifested. A good many years ago a proposition to supply New York City from across the North River aroused this feeling in a marked degree, and it has never entirely subsided.

A Rolling Mill Engine of 4,150 h.p., with two 47⅜x49⅜-in. steam cylinders side by side is in use at the Hungarian state steel works near Miskolc. Owing to the variable demands for steam, a horizontal steam drum receiver bridges the space between the cylinders and the 16.5-in. branch to each cylinder comes from the bottom of the receiver, but is extended vertically within it with the open end near the top of the drum so as to receive dry steam. The drum is 4 ft. 11 in. in diameter and has a capacity of two and one-half times the volume of both cylinders. The steam, which is supplied at a pressure of 88 lb., passes through steam packets provided for the cylinders on its way to the valves.

The High-Speed Electric Railway which will be put under construction this spring by the New York, Westchester & Boston Ry. Co., will be controlled by the owners of the Interborough Rapid Transit Co., which leases the subway and elevated lines. There will be three and four tracks on a private right-of-way without grade crossings, and the cars will be of such a size that they can run over the Interborough lines. Mr. William Barclay Parsons is a director and consulting engineer of the company. Mr. John Bogart is another consulting engineer, Mr. Samuel Hunt is a director and will have charge of the construction, and Mr. William A. Pratt is chief engineer. The total single-track length of the road will be 117 miles. It should be added, however, that the advocates of a rival enterprise threaten to block this proposed work by means of equity suits.

The Completion of the Panama Canal is now pretty well assured within the time limit set by the Commission of 1899-01, assuming that the canal is built with locks and a summit level from 85 to 90 ft. above the sea. This is shown by the following facts regarding the equipment already ordered and partly delivered. This plant includes 17 steam shovels with 2½ to 5-yd. buckets, bought in the United States, and a 1½-yd. French shovel which has been repaired; 3 unloaders and plows, 4 earth spreaders, 48 dump cars, about 2,000 French dump cars now undergoing repairs, 500 steel flat cars, 3 stone crushers, 25 steam drills, 2,500 tons of new rails, about 175 miles of rails now at the Isthmus, and 178,000 cross-ties. Basing an estimate of progress on the steam shovel capacity now installed and under contract, and assuming one bucket two-thirds full per minute for nine hours daily and for 20 days per month, the output in eight years would be 44,240,000 cu. yd. The excavation of the Culebra Cut for the 85-ft. summit level canal will call for the removal of 43,000,000 cu. yd., and hence this plant already ordered may be expected to execute the cut within the eight-year period estimated by the Commission of 1899-1901. It is well known that all other parts of the canal can be built during the time required for this cut.

The Bridge Crush in New York is one of the famous sights of the metropolis. About 5.15 o'clock every night at the Manhattan terminal of the Brooklyn Bridge, there can be witnessed the greatest travesty on transportation to be seen in the country, for at that time an enormous number of people endeavor to pass along the utterly inadequate passages to the elevated and surface cars running to Brooklyn. Only the good nature of the average American crowd prevents an evening gladiatorial combat that would have made Rome howl. It all results from disregard of an elementary law of nature, that two objects cannot simultaneously occupy the same place. Fortunately transportation experts have pointed this out from time to time, and it now seems as though the manifest method of relieving the disgraceful condition will shortly be adopted by the various official departments responsible for finding a remedy. This is to connect the Manhattan terminals of the Brooklyn, Manhattan and Williamsburg bridges by a double-track elevated road, on which trains will run continuously in both directions. In this manner passengers can be distributed and collected at several stations in Manhattan instead of all being dumped at a single inadequate terminal, and there will be no delays due to switching trains at a terminal, as is now the case. This solution of the problem was advocated several years ago by Messrs. Boller, Prout and Whinery, and nothing approaching it in value has yet been suggested. Its reconsideration at the present time is a hopeful but unexpected tribute to the sufferings of Brooklyn residents.



View of Station from River.

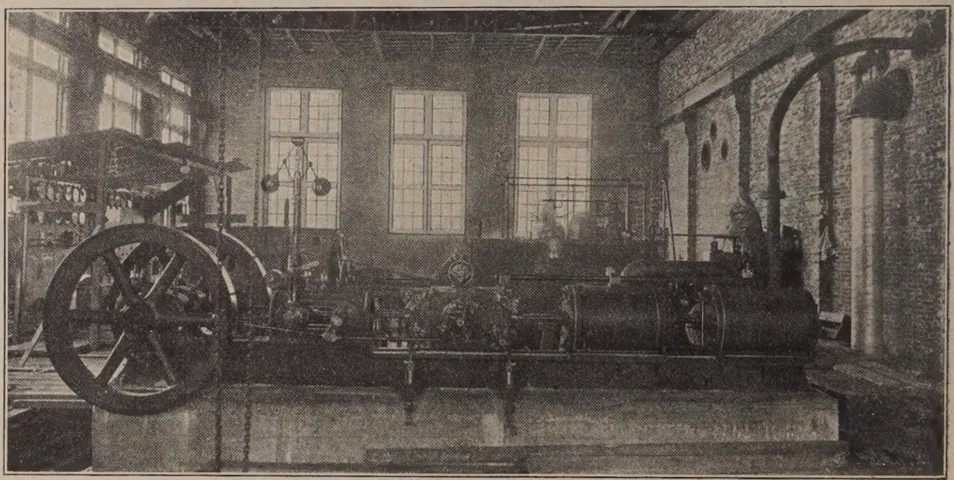
The Dutch Point Plant of the Hartford Electric Light Company.

A steam-turbine electric central station of 4,000 kw. rated capacity has lately been added to the power-generating properties of the Hartford Electric Light Co., Hartford, Conn. As an example of a plant equipped with modern machinery and apparatus of the character widely regarded as offering high operating economies, it is an interesting installation, and it is in keeping with the past records of the company that the equipment will include testing appliances of a permanent nature, so that data can be obtained whenever desired of the actual working performance of different adjuncts of the plant. The station as a whole stands as an instance of rapid erection and from the standpoint of details in design is of interest in respect to the arrangement of turbine and boiler rooms and to the systems of steam piping.

The reputation that the company has already made as a pioneer in adopting new apparatus in power generation and transmission has given it marked prominence, especially when its local restrictions as a public supply corporation for a city of not much over 90,000 population are remembered. It received, for instance, the first Westinghouse-Parsons steam turbine used for electric lighting in this country, the only machines of this type in use before it being installed in Westinghouse shops, while its early work, under the supervision of Prof. Wm. Lispenard Robb, in series alternating-current arc lighting has, of course, contributed considerable information on central station operation. In the present case, however, it cannot be said to have embarked on further pioneer work, when the recommendations of Messrs. Westinghouse, Church, Kerr & Co., were incorporated in the plant which the latter have built, but it can consistently be held, in view of the company's past methods of investigation, that the combination of machinery adopted is safely a good one for a steam-electric plant in a region where the cost of coal is high.

The company receives power from both steam and hydraulic plants, the latter, including the Tariffville station described in this journal some time ago, supplying current by overland alternating-current transmission. These water-power sources, however, are intermittent, owing to the variations of the flow of water harnessed, and it became desirable to obtain additional steam power to secure against failure of the power supply as well as to provide for the constantly increasing patronage and to allow for replacing some older steam-driven electric generating machinery. The plant that was accordingly constructed is located at Dutch Point on the Connecticut River, Hartford; it will relieve the Pearl St. steam plant, which is to be remodeled somewhat to serve, with its storage battery, as a substation in a concentrated load center.

The site of the station required piling 45 ft. in length under wall and machine foundations. These were capped with concrete 4 ft. thick and the spaces intervening between foundations were filled with concrete 2 ft. thick, forming with the foundations a monolithic concrete floor. The concrete work, however, was tied together with square-section steel bars and these horizontal reinforcing rods were carried vertically upward 6 ft. in the concrete bases of the walls. Owing to the proximity of the station to the river it was necessary to support the machinery above recorded flood levels and a basement was provided under both the boiler and turbine rooms, with relatively massive concrete walls carried 18 in. above the high floods. This left a headroom under the floor of the boiler room of 16 ft. and under the floor of the turbine room of 19 ft., the latter being 3 ft. above the boiler-room floor. The two rooms lie side by side in a usual way, with partition wall between, while the roof trusses over the two rooms are on the same level with their upper chords pitching slightly from the ridge over the division wall toward the outside walls. Above the concrete, the walls are of brick 17 in. thick with stone trimmings and, on the inside of the turbine room, have pilasters which serve mainly to support the girders of a 25-ton Niles-Bement-Pond electric traveling crane. The end walls of the station are carried in parapets above the general level of the Hydrex-covered reinforced-concrete roof, and these serve to hide more or less the monitors which have been provided to light and ventilate the boiler room. The turbine room is 48 ft. wide inside, 3 ft. 3 in. wider than the boiler room, and the total area of the two rooms, including the brick walls, is 11,560 sq. ft., or 2.3 sq. ft. of area per kilowatt of rated output, on the basis of the generating capacity that the turbine room can accommodate.



Interior of Turbine Room with Dry-Vacuum Pump in Foreground.

As to the general character of the arrangement of apparatus, reference may be had to the accompanying illustrations. The brick form of smoke passage is employed, placed behind the boilers against the station partition wall at the floor line, and the chimney is outside and independent of the building, requiring a short duct outside to continue the passage into the chimney base. This leaves the headroom over the boilers clear for the steam and feed piping. The feed pumps, together with feed-water heater and hot well, are located at one end of the room. The boiler-room basement leaves abundant space for ash handling, and the blow-off piping and the steam blowers employed for forced draft are also accessible at this point. Hand firing was determined on and no provision was considered necessary for overhead coal bunkers.

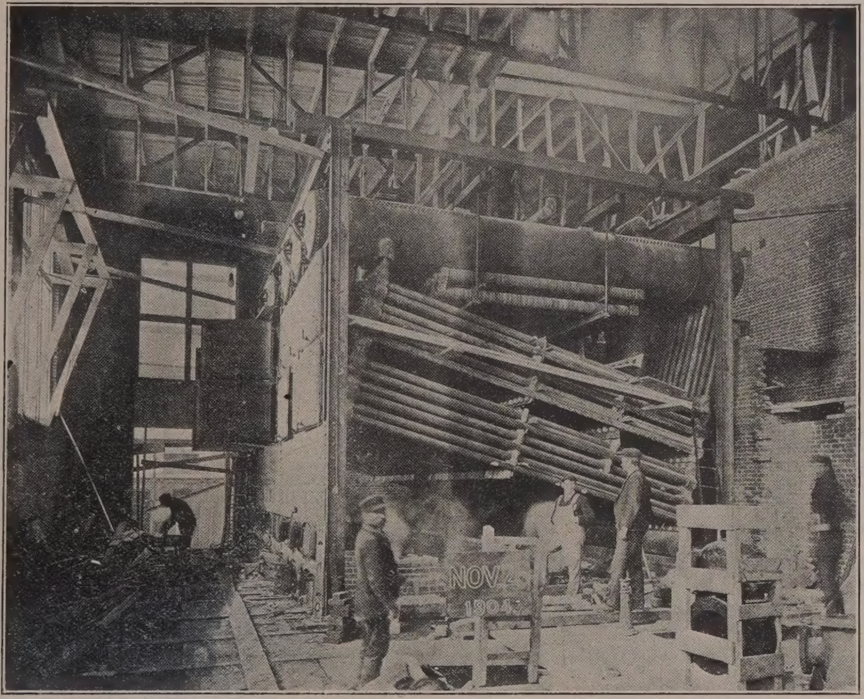
In the turbine room are the main generating and exciter units and the two-stage dry-vacuum pumps used with the former, while the piping, condensers and pumps are placed in the turbine-room basement. There are no light wells in the turbine-room floor, but a few gratings between turbines and the division wall provide for reaching auxiliary turbine pumps and the like. The circulating pumps, however, are placed in a pump house built against the turbine room toward one end; this is on the river side of the station, and practically over the intake. The interior walls of the turbine room are finished with a 5-ft. 6-in. wainscoting of enameled tile with dado and base line to relieve it, while the walls of the boiler room are brick finished. The floors are of reinforced concrete with a white cement tile surface in the turbine room laid by the Hartford Faience Co., of Elmwood, Conn.

The boiler plant consists of six Aultman & Taylor water-tube boilers, each having 5,226 sq. ft. of heating surface, with the boilers set in batteries of two each. The tube surface of each boiler is arranged in 21 double sections, giving a height of 12 tubes, which are 4 in. in diameter and 18 ft. long, and there are three 36-in. steam drums to each boiler about 23 ft. long. The grates, which were furnished with the Parson blowers, are about 7x12 ft. in area, making the ratio of heating to grate surface 62.2 to 1.

The boilers are all equipped with forced draft from steam blowers furnished by the Parson Manufacturing Co., of New York, and with Foster superheaters built by the Power Specialty Co., of New York. Five of the boilers have the latest form of this superheater, with the tubes placed longitudinally in the boiler over the first and second passes of the gases, while the sixth boiler has an older form, with the tubes supported laterally over the second pass, this superheater having been taken from the Pearl St. plant. Each of the new superheaters has 960 sq. ft. of superheating surface and is designed to superheat the steam 100° Fahr., at the rate of 3x5,226=15,678 lb. of steam passed per hour through it, with a boiler evaporation of 3 lb. per square foot of heating surface per hour. The specified boiler pressure is 150 lb.

The superheater in each boiler is divided into three sections; the steam from each boiler steam drum is conducted through the superheater section underneath it and the three outlets from the superheater are joined into the boiler cross-over pipe. The tubes consist of 4-in. Shelby cold-drawn tubes with 3¼-in. boiler tubes held centrally within them and of cast-iron rings or gills shrunk on the outer tubes. The steam, which is passed through the ¼-in. annular space between the tubes, attains a velocity of 6,000 ft. per minute. The gills, besides serving to secure a maximum superheating surface per unit of length, act, owing to their relative mass, more or less to store heat and thereby minimize fluctuations of the degree of superheat with variations in the temperature of the gases of combustion.

Three steam blowers are furnished to each boiler, set in the lower part of the bridge wall and delivering the air and steam into the ash pit. Each is supplied with steam at boiler pressure taken from the main steam header, with a 1½-in. extra-heavy branch pipe for the three blowers of each boiler passed in the usual way through the boiler setting to superheat the steam and in that way to ensure dry steam at the nozzles. The supply of steam is controlled automatically by a Parson regulator, which cuts out the blowers when the working pressure is reached and puts them in service again when it begins to drop, and the ¾-in. steam pipe to each individual blower is, of course, further provided with a valve by which the flow to any blower may be throttled or cut off. The bridge wall is provided with an air space placing the ash pit in communication with the furnace, to admit sufficient air to complete combustion in the combustion chamber, and the entrance in the ash pit to the air passage is fitted with dampers having operating rods extending through the ash-pit front.


Boilers during Construction, Showing Method of Suspending Superheater.

A brick-lined ash hopper is suspended under the ash pit, with a gate in its discharge for dumping ashes when desired into ash cars in the basement, and soot spouts are also provided, one in the floor back of the bridge wall of each boiler and another back of the wall under the mud drum, and both toward the partition wall that separates the boilers of each battery. A feature of the installation is the provision of openings on the level of the grate immediately within the firedoors, which openings are fitted with a form of dumping dead plate supplied by the Parson Manufacturing Co. When the fires are cleaned, ashes raked forward are dumped into the ash pit, where they fall into the ash hopper. These openings are ordinarily closed with iron covers. It may be further added that the location of the blowers so that the air induced into the ash pits is drawn from the cellar is regarded as an advantage in that the air withdrawal at least effects ventilation of the cellar. The grates are designed for and the forced-draft system is, of course, applied largely to allow for burning smallest sizes of anthracite or bituminous coals without change of grate bars.

The chimney is a steel stack built by the Coatesville Boiler Works, 135 ft. high and 10 ft. in inside diameter. It stands on a concrete base making the top of the stack 150 ft. above the grate bars. It is lined for 20 ft. within the bottom of the steel portion with common brick, and the space between the brick shell and the flaring bottom of the steel shaft is filled in with concrete, as adding to the stability of the stack and preventing opportunities for the collection of moisture. No effort is made not to have the brickwork, concrete and steelwork bonded at the abutting surfaces, for with the decrease in temperature in passing through the substances from the inner surface of the stack outward the linear expansion is assumed equal for all three materials.

The turbine generating units consist of Westinghouse-Parsons steam turbines and direct-connected Westinghouse alternating-current generators. One unit, not yet fully installed, is of 2,000 kw. capacity, two are of 1,000 kw., and space is left for a fourth unit also of 1,000 kw. capacity. It should be stated, however, that the boiler capacity in the present building would hardly be large enough to supply all four units simultaneously, which fact is a commentary on the relative floor areas required for steam engine and for steam-turbine plants. The exciters consist of heavy-duty Chandler & Taylor simple horizontal automatic engines, direct connected to 125-volt 50-kw. Westinghouse dynamos. A system of compressed air lines for cleaning purposes has been installed, an 11-in. Westinghouse locomotive-type compressor supplied for this purpose.

The turbines exhaust into surface condensers which are operated in connection with Corliss two-stage horizontal flywheel air pumps. There are two condensers, which, with the auxiliaries, were furnished by the Alberger Condenser Co., one condensing outfit for the 2,000-kw. unit and the other for the two 1,000-kw. units. Each condenser is of the counter-current type, with 6,000 sq. ft. of cooling surface, and the dry-vacuum pump has an 8-in. steam cylinder, two 18-in. air cylinders and a 24-in. common stroke. The wet-vacuum pump is a 6x5¾x6-in. duplex pump, while the circulating pump for each outfit, located in the pump house, is a 14-in. Alberger centrifugal pump mounted on a vertical shaft and direct driven by a 50-h.p. induction motor at the turbine-room floor level, while the pump is at basement level. The condensing water intake is about 40 ft. from the pump house and a flume, which necessitated pile supports on account of the nature of the soil, conducts the water to a well underneath the pump chamber. The suction pipe ends are 19 ft. below the pumps, and both injection and discharge pipes are 14 in. in diameter. The wet vacuum pumps discharge by a 4-in. line into the hot well.

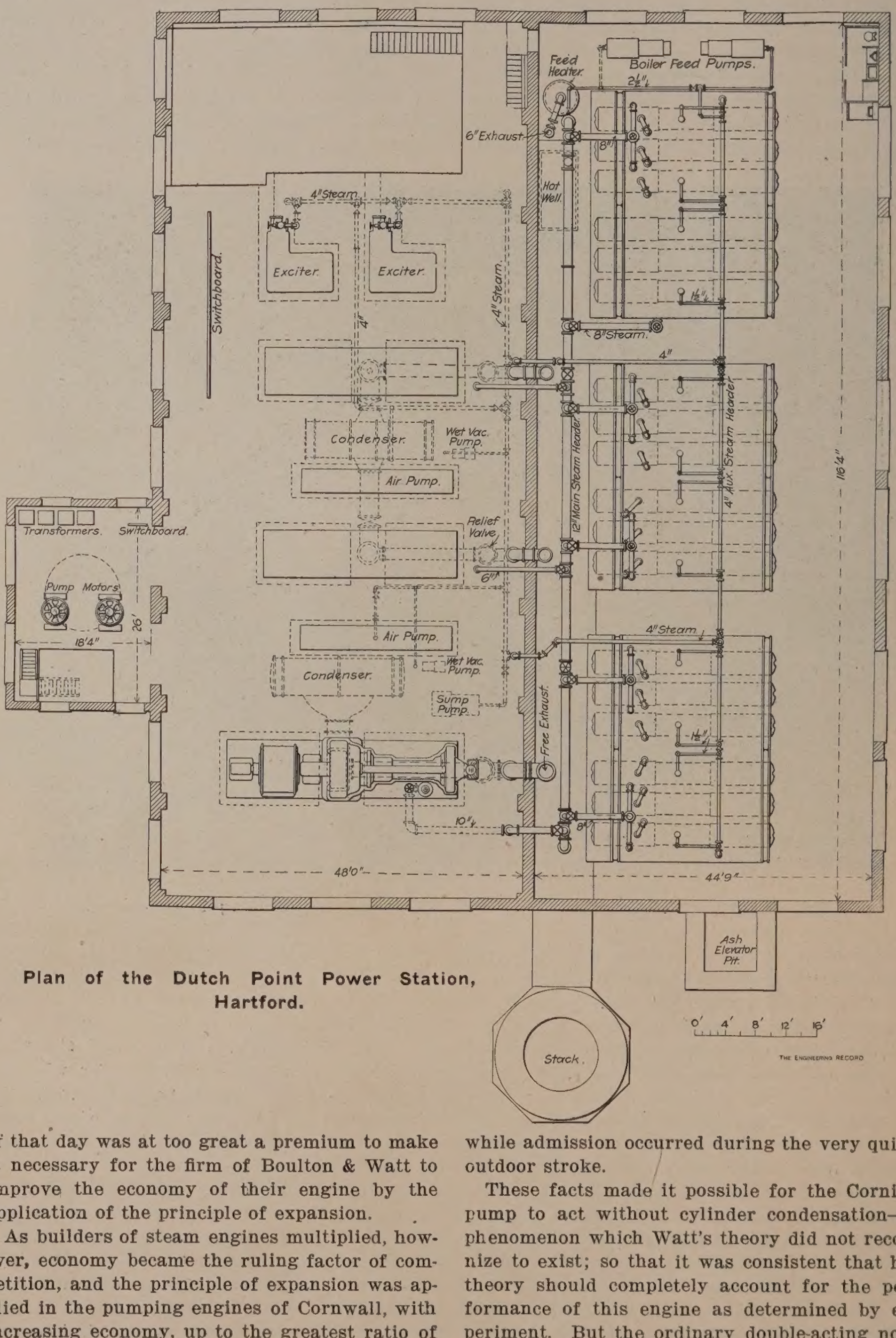
The steam piping is divided into two systems, the main lines, for carrying superheated steam to the turbines, and the auxiliary lines, supplied from the safety-valve outlets on the boilers, for carrying saturated steam to the exciter engines and the pumps. For the main system there is a header supported overhead behind the boilers, and the branch pipe to each turbine is taken from it in as direct a line as possible. The branch to the large turbine drops vertically through the turbine room into the basement before it is terminated at the automatic valve on the turbine. Two valves are provided in the branch from each boiler, the one immediately over the cross-over pipe being the Pearson automatic non-return type to prevent a back flow of steam into a boiler on the failure of a tube or the like, and there are two valves in the header itself, dividing it into three parts, one corresponding to each pair of boilers. At the bottom of the branch to each turbine the piping is fitted with a tee, as indicated in the drawings, which serves as a drain pocket. These and other points of drainage of both the main and auxiliary systems of live steam piping are drained by means of the Holly system of returning directly to the boilers without pumping.

The auxiliary steam system includes a 4-in. main extending across the boilers and a 4-in. main in the turbine-room basement, parallel with the boiler-room main and supplied from it by two 4-in. pipes, each having a valve near the boiler room main. Each of the two 1½-in. pipes from each boiler to this system has two valves, and the 4-in. main is divided by valves into three parts like the main header. In the turbine-room basement connections are taken to the condenser pumps and the exciters. At the boiler-feed pumps the auxiliary main over the boilers is joined by a cross pipe into the main header, so that steam to the feed pumps can be obtained from either source. The Parson forced-draft blowers receive steam from each end of the main header. It will be noted that except for the connections in the turbine-room basement, practically all the other valves are reached over the boilers, and an extensive system of iron-grating walks, readily accessible from the boiler-room floor, have been erected along the main header with branch platforms over each battery.

The feed water is mainly obtained from the hot well, where the wet-vacuum pumps deliver the condensation effected in the condensers. The fact that oil is not used in the steam passages of the turbines makes it possible to utilize this water over and over again. Additional water to make good the steam used by the auxiliaries and other losses is obtained in an interesting manner from the circulating water taken from the Connecticut River. The scheme by which this is effected is shown in the accompanying diagram. By means of a float in the hot well, water from the water space of each condenser is allowed to enter the steam space where it can assist in condensing the steam and itself become warmed; it is then taken, together with the condensed steam, by the wet-vacuum pump and delivered into the hot well. The float, when the well level drops, actuates a pilot valve, which in turn allows steam to reach a Ford regulating valve on each condenser. This valve then opens the water passage to the steam space. By means of a bypass the water can be admitted to the condenser steam space when the automatic apparatus is not used.

Water can also be obtained directly from the Connecticut River by a 12x14x10-in. pump in the turbine-room basement, this pump discharging into the hot well. This is also intended, however, to serve the testing plant mentioned and to act as a sump pump whenever flood waters succeed in penetrating the power-station basement. The hot well is a steel tank, 10x5 ft. in plan and 5 ft. high. The feed pumps, which are of the 12x7x12-in. Deane outside end-packed duplex plunger type, installed in duplicate, discharge through the feedwater heater, which is of the National design, into the feed mains. These are in duplicate, run side by side over the boilers, one for the hot feed from the heater and the other for the cold feed when the heater is by-passed. The connections opposite every pair of boilers is shown in an accompanying detail; the piping is of brass.

The station was designed and built by Messrs. Westinghouse, Church, Kerr & Co., of New York. The remarkable speed with which the work has been conducted is shown by the following summary of dates. The excavations were started Aug. 16, 1904; the first concrete was laid Sept. 23; the first brick, Oct. 8; the turbine was moved to its foundations, Nov. 28; the building was closed in Dec. 5; and the first turbine was put in service on the line on Dec. 18, four months after the excavations were begun and 20 days after the turbine was put in place. Mr. A. C. Dunham is president of the Hartford Electric Light Co., Mr. R. W. Rollins is manager, Mr. E. F. Lawton is superintendent and Mr. F. M. Wilbraham is chief engineer.



Plan of the Dutch Point Power Station, Hartford.

The Efficiency Test of an Electric Hoist built by the Sandycroft Foundry Co., of Chester, England, for a slate quarry in North Wales, was reported in "The Electrician," of London. The hoisting machine was required to maintain a tension on the rope of 5,000 lb. at 330 ft. per minute. The motor speed was 600 r.p.m. and the speed reduction was secured by two pairs of spur gears with ratios of 16 to 83 and 17 to 80, respectively, making the drum speed 24.6 r.p.m. For the test the working brakes were replaced by Prony brakes. A combined efficiency (that is, the power at the brakes divided by the electric power delivered to the motor), of 85 per cent. at three-quarter load was obtained. The figures for full load and half load were given as 84.6 and 83.1, respectively. It is stated that the efficiency of the motor was 90.5 per cent., but the last figure was not absolutely trustworthy, so that it was not possible to state the efficiency for the gearing itself.

The Best Economy of the Piston Steam Engine at the Advent of the Steam Turbine.

A paper presented before the Mechanical Section of the International Congress of Arts and Sciences, by Prof. J. E. Denton.

When James Watt retired from business, at the beginning of the nineteenth century, he had declared his belief, based on theoretical calculations, that the water consumption of a steam engine per horse-power decreased with the increase of the ratio of expansion until the pressure of release should be equal to the exhaust pressure. But, although Watt invented a valve-gear with which to test his theory, he never worked steam expansively to any practical degree in any of the engines built by him, because the demand for them simply as multipliers of the power available from other prime movers of that day was at too great a premium to make it necessary for the firm of Boulton & Watt to improve the economy of their engine by the application of the principle of expansion.

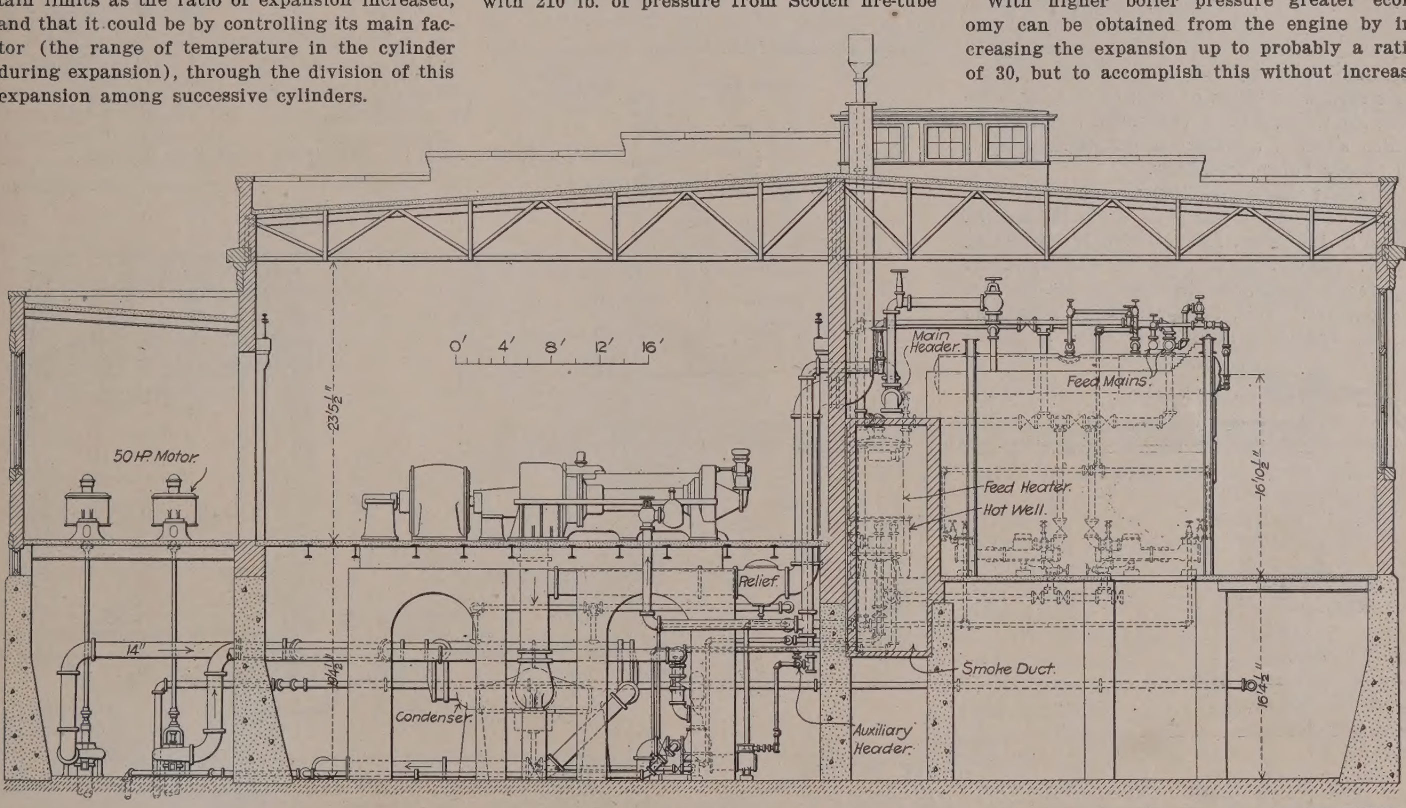
As builders of steam engines multiplied, however, economy became the ruling factor of competition, and the principle of expansion was applied in the pumping engines of Cornwall, with increasing economy, up to the greatest ratio of expansion consistent with commercial limits of size of cylinder per horse-power. Hence, when in 1840 one of the leading Cornish pumps was reliably tested for water consumption at ratios of expansion varying from 1.5 to 3.5, with results showing from 24 to 16.5 lb. of steam per horse-power-hour, and it was found that these figures agreed with Watt's theory, belief in the latter was practically universal, and expansion was relied upon to yield similar results, in all important engines of land and sea, up to 1855.

The engineers of this time failed to realize, however, that the Cornish pump, with its single action and equilibrium exhaust, never exposed the working-end of its cylinder to the temperature of the condenser, so that the range of temperature to which the admission-end of the cylinder was exposed was only a fraction of that undergone by the steam, a fact which realized the conditions of action of a compound engine. They also failed to realize that the steam was superheated during admission by excessive wiredrawing from the boiler pressure of 45 lb. to 18 lb. absolute, and further, that a live-steam jacket heated the cylinder walls to initial temperature during a very slow indoor stroke, while admission occurred during the very quick outdoor stroke.

These facts made it possible for the Cornish pump to act without cylinder condensation—a phenomenon which Watt's theory did not recognize to exist; so that it was consistent that his theory should completely account for the performance of this engine as determined by experiment. But the ordinary double-acting non-jacketed engine of the marine and stationary practice of that day did not realize these passive cylinder-wall actions of the Cornish pump. Consequently it became gradually evident toward 1860 that the steam engines of the world were failing to realize the results due to Watt's theory. This conclusion was deduced from service records of coal consumption tests, as from 1840 to 1860 no impressive water consumption tests were made.

At the latter date, however, Isherwood's elaborate and thorough tests on the United States steamer "Michigan" appeared, showing a limit to the gain in steam economy by increasing ratios of expansion through the existence of some action of the steam unknown in its character but evidently not taken account of by Watt's simple theory of expansion.

Rankine's sagacious analysis of the "Michigan" data located this missing factor of the theory in the powerful waste action of the cylinder walls, constituting, with all of its complicated dependence on range of temperature, cylinder surface, speed, and jacket influence, what we now term the "loss due to cylinder condensation." It was then quickly recognized that to realize the gain due to Watt's theory of expansion, the percentage of loss due to cylinder condensation must be confined within certain limits as the ratio of expansion increased, and that it could be by controlling its main factor (the range of temperature in the cylinder during expansion), through the division of this expansion among successive cylinders.



Cross-Section through Pump House, Turbine Room and Boiler Room, Dutch Point Plant, Hartford.

Development of Marine Economy.—The idea of the subdivision of the range of temperature was first extensively applied in marine practice to compound the simple condensing engine using steam at 60 to 80 lb. boiler pressure with six expansions without either increasing the boiler pressure or expansion ratio. No practical gain in economy resulted from this change, as, while the range of temperature of the cylinder was cut in two and the cylinder condensation loss thereby reduced, the gain accruing therefrom was neutralized by the mutilation of card area, due to the discontinuity of the expansion curve and the loss of pressure between cylinders. The water consumption, therefore, remained at about 19.5 lb. per horse-power, which had been afforded by the simple engine.

But the marine boiler making art had now advanced so as to make 150 lb. steam pressure available. Therefore, the engine was able to use fourteen expansions and secure such an increase in mean effective pressure as would enable a three-cylinder engine to weigh practically no more per horse-power than did that of the compound system. The marine world, therefore, sought the increased economy due to Watt's theory from fourteen expansions divided among three cylinders, so that the range of temperature in each cylinder was the same as that in the compound system with lower boiler pressure. The cylinder-condensation loss was thereby controlled so that the gain in economy due to the greater ratio of expansion under Watt's law preponderated over the loss due to broken card area. The result was, taking the merchant marine engines as the standard of economy, that the water consumption fell to 15 lb. per horse-power. The triple-expansion engine at sea, therefore, afforded the first real gain in economy over the simple engine of six expansions which was prevalent when the phenomenon of cylinder condensation was discovered.

Further development of marine boiler construction now supplies the merchant marine with 210 lb. of pressure from Scotch fire-tube boilers. This permits the use of fifteen expansions with 39 lb. of total mean effective pressure, or about 30 per cent. increase over that of the 150 lb. triple-expansion engine; this, together with increased revolutions, by virtue of improvements in lubrication and construction of bearings supplemented by more perfect balancing of moving parts and no greater mutilation of card area than in the triple engine, permits the use of four-stage expansion engines whose weight is within satisfactory commercial limits.

With the expansion divided into four stages, in four or more cylinders, the temperature range per cylinder is reduced over that of the triple engine with a resulting reduction of cylinder-condensation loss so as to afford a water consumption of 13.6 lb. per horse-power-hour of the main engine, with a vacuum of 25.5 in. This economy is attained with saturated steam without jackets or reheaters, the latter never having shown sufficient gain on marine engines to compensate for the care necessary to manage them; and it applies to all engines above 5,000 h.-p., the gain in economy due to larger size being indistinguishable by service records.

With an attached air pump, the usual auxiliaries consume steam which increases the water consumption to 14.4 lb. per horse-power of the main engine. The exhaust of these auxiliaries applied to heating the feed water, supplies it to the boilers at fully 200° Fahr. From this temperature Scotch boilers with Howden's system of draught, burning about 21 lb. of the best semi-bituminous coal per square foot of grate per hour, evaporate 11 lb. of actual feed water per pound of coal. Thus for each indicated horse-power of the main engine 1.3 lb. of coal are consumed per hour.

Without an increase in boiler pressure above 210 lb., further increase in economy can only be obtained with higher ratios of expansion, and this is prohibited because the consequent reduction of mean effective pressure would increase the weight of the engine per horse-power beyond commercially acceptable limits.

With higher boiler pressure greater economy can be obtained from the engine by increasing the expansion up to probably a ratio of 30, but to accomplish this without increase of weight of engine per horse-power would require a working pressure of steam of 300 lb. per square inch. This must be obtained from water-tube boilers, as the Scotch boiler is now at the limit of practicable construction and allowable weight when built for 210 lb. steam pressure.

Higher economy of engine is obtainable, with present pressures and ratios of expansion, by the use of superheated steam, but the application of the latter has not thus far shown a gain in coal economy in transatlantic marine practice. This is doubtless ascribable to the use of imperfectly designed superheaters; but the increase of cylinder oil which superheating requires makes its successful introduction at sea questionable, on account of the difficulty of protecting the boilers against over-fouling by accumulation of oily deposit.

At the advent of the steam turbine in marine practice, therefore, the degree of economy with which it must compete in marine engines on the largest scale is that of a quadruple-expansion system expanding saturated steam with 210 lb. pressure fifteen times, into a vacuum of

25.5 in. with an economy of 13.6 lb. of water per horse-power-hour of the main engine; which will operate, with its auxiliaries, from Scotch boilers on the Howden system, with a consumption of 1.3 lb. of the best semi-bituminous coal per indicated horse-power-hour of the main engine.

If the turbine could operate screw propellers efficiently with the same rotational speeds for a given horse-power that it uses in electric service, the record for economy already established by the turbine shows its ability to easily compete with these conditions of performance of the best marine engine. But such rotational speeds for the turbine are inconsistent with the degree of screw propeller efficiency available from piston engines.

Therefore the possibilities as regards steam economy of the turbine in marine practice are as yet too unsettled to permit of their definite statement within the limits of this paper.

Development of Stationary Engine Economy.—Stationary engines at the date of the discovery of cylinder condensation were affording the maximum economy in simple condensing cylinders expanding steam of from 60 to 80 lb. pressure six times, with a vacuum of about 27 in., which afforded a water consumption of about 19 lb. per horse-power-hour.

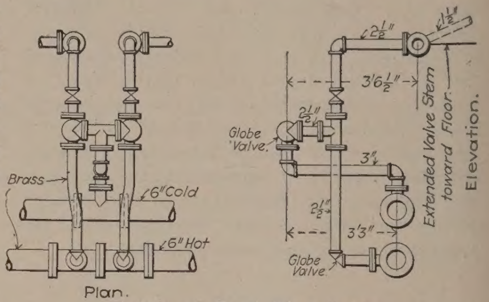
The first noteworthy improvement upon this degree of economy was obtained in the Leavitt pump at Lawrence, Mass., which by expanding 120-lb. steam sixteen times in two cylinders secured a water consumption of 16.5 lb. per horse-power. This, however, was a compound engine without a receiver, or what is known as the "Wolff" system, which does not divide the range of temperature due to expansion between the two cylinders, as the high cylinder is in connection with the low during the whole of the latter's expansion period. This fact and the slow speed of 12 r.p.m. made the initial cylinder condensation 40 per cent., or nearly twice that of the six-expansion simple condensing engines; besides which, live-steam jackets on both cylinders consumed 10 per cent. of the total steam.

The gain in economy over the simple engine was therefore due entirely to the influence of the high ratio of expansion aided by high initial pressure and so strong a re-evaporative effect that the expansion line was outside of a Mariotte curve to the end of the expansion. The combined effect of these more than offset the negative influence of the high percentage of cylinder condensation. The engine was, however, the most economical of its time (1872), and it is interesting to note that its conditions of steam action were widely in contrast with that of the most economical Cornish pumping engine of 1840, which afforded precisely the same water consumption of 16.5 lb. by expanding 30 lb. steam three and one-half times, with a complete avoidance of loss by cylinder condensation.

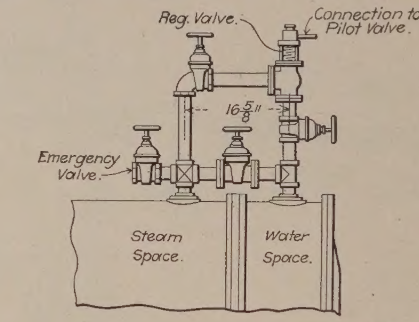
The first prominent advance in economy by division of the range of temperature was obtained about 1878 in the Corliss Pawtucket compound pumping engine. This also expanded 120 lb. steam sixteen times in two cylinders but with a receiver between them; whereby, with the aid of a speed of 50 revolutions and only 5 per cent. jacket consumption, the cylinder-condensation loss was reduced to 25 per cent., and a water consumption of only 13.7 lb. resulted. This result led Corliss to introduce similar compound engines into mill practice, and they were then rapidly substituted throughout the world in all large power-using industries, for the single six-expansion condensing engine. All makers of four-valve drop cut-off engines in both the United States and Europe obtained from them a water consumption of from 13.5 to 14 lb. per horse-power with about 125 lb. steam pressure and about sixteen expansions.

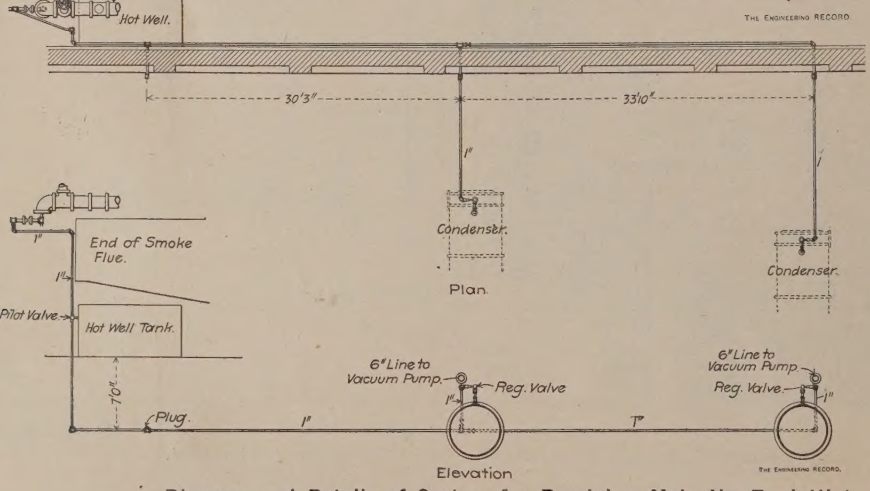
The gain from one division of temperature being thus established, triple-expansion engines were quickly introduced for mill and electric service by Corliss and Allis in the United States and Sulzer in Germany, to obtain a further gain from two divisions of temperature. None of the triple-expansion engines succeeded, however, in reducing the water consumption below 12.5 lb. per horse-power, which was not a sufficient gain over the compound engine to offset the extra cost and care of the third-expansion stage. Its use was therefore quickly abandoned in mill and electric-light service in favor of the compound engine.

Such a general readoption of the compound type resulted in a variety of cylinder ratios being used as involving possibilities of improved economy over the ratio of 4 to 1 introduced by Corliss. The first radical departure appeared in the Rockwood & Greene system, which was introduced into New England with a cylinder ratio of about 7 to 1, and clearances of about 2 per cent., instead of the 4 per cent. value previously prevailing. With 150 lb. steam pressure, live-steam jackets on either the heads or barrels of both cylinders, and a live-steam reheating receiver, such engines have afforded 12.45 lb. per horse-power with saturated steam expanded twenty-six times into about 27.5 in. of vacuum. Without the jackets and reheater in use, about 2 per cent. greater water consumption is obtained. The jackets and reheater, when in use, consume only about 8 per cent. of the total steam, with practically 25 per cent. of cylinder condensation under both conditions.



Detail of Feed Pipe System.





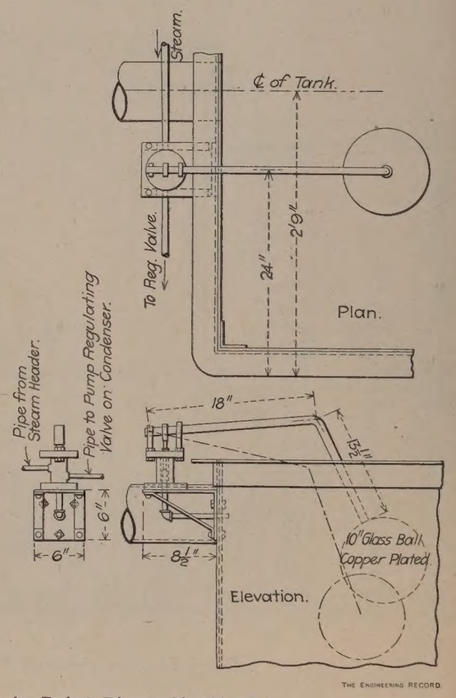


Diagram and Details of System for Receiving Make-Up Feed Water, Dutch Point Plant, Hartford.

This performance represents the best economy derived from the compound engine for mill and electric practice up to within a few years ago, and it has largely established the belief that a cylinder ratio of about 7 to 1, with so small a clearance as 2 per cent., is necessary to maximum compound engine economy. During the last two years, however, the following records have been established:

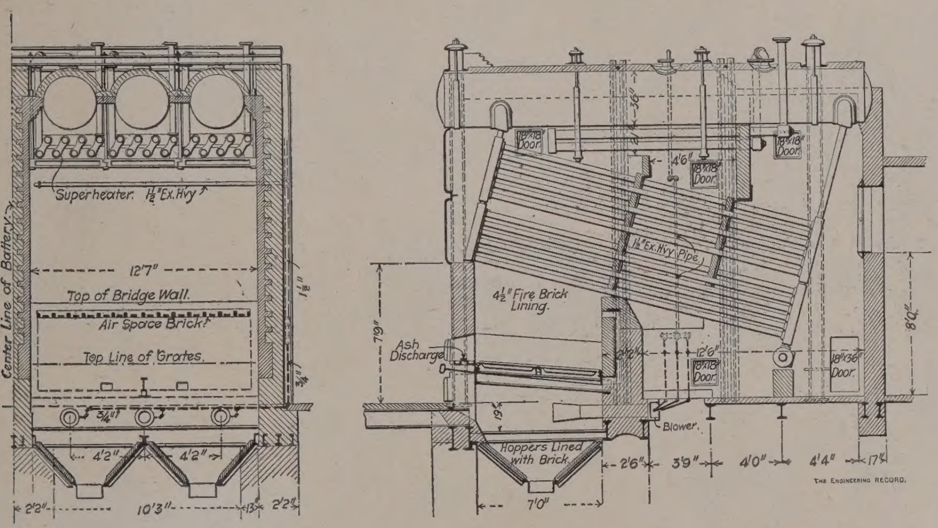
(1) With an 850-h.p. Rice & Sargent compound Corliss engine running at 120 r.p.m., having a 4 to 1 cylinder ratio, clearances of 4 per cent. and 7 per cent., live jackets on cylinder heads and live steam in reheater, Professor Jacobus, of Hoboken, found for 600 h.-p. of load, with 150 lb. pressure of saturated steam, 28.6 in. of vacuum, and 33 expansions, 12.1 lb. of water consumption per horse-power—a result produced with a cylinder-condensation loss of 22 per cent., and a jacket consumption of 10.7 per cent. of the total steam consumption.

(2) With a 250-h.-p. Belgian Van den Kerchove poppet-valve compound engine, running

at 126 r.p.m., with 2.97 to 1 cylinder ratio, clearances of 4 per cent., steam chest jackets on barrels and head, and no reheater, Professor Schröter, of Munich, found 117 h.-p. of load, 130 lb. pressure of saturated steam, 27.6 in. of vacuum, and 32 expansions, 11.98 lb. of water per horse-power—a result produced with a cylinder-condensation loss of 23.5 per cent., and a jacket consumption of 7 per cent. of the total steam consumption in the high cylinder jacket and 7 per cent. in the low jacket.

(3) With the Westinghouse twin low-cylinder, compound combined poppet-valve and Corliss-valve engine, at the New York Edison plant, running 76 revolutions, with 5.8 to 1 cylinder ratio, clearances of 10.5 per cent. and 4 per cent., without jackets or reheater, Messrs. Andrew, Witham and Wells found for the full load of 5,400 h.-p., 185 lb. steam pressure, 27.3 in. of vacuum, and 29 expansions, 11.93 lb. of water per indicated horse-power, a result produced with an initial condensation of about 32 per cent.

These facts show that the minimum water consumption of the compound mill engine and electric light engine of the present date, using saturated steam, is not dependent upon any particular cylinder ratio and clearance nor upon any system of jacketing, but that the essential condition is the use of a ratio of expansion of about 30, above which the cylinder-condensation loss is liable to prevail over the influence of the law of expansion. The conclusion appears warranted, therefore, that if this ratio of expansion is secured with any of the current cylinder and clearance ratios, and with any existing system of jackets and reheaters, or without them, a water consumption of 12.4 lb. per horse-power is possible, and that a variation of four-tenths of a pound below or above this figure may occur by the accidental favorable, or unfavorable, jacket and cylinder-wall expenses which are beyond the exact control of the designer.



Boiler Setting at Hartford Power Plant, Showing Superheater and Steam Blowers.

Economy of Compound Reciprocating Engines and of Turbines.—In order to compare the economy of the piston engine with that of the steam turbine, we must use the water consumption per brake horse-power, since no indicator card is possible from the turbine; and furthermore, we must use the average water consumption for the range of loads to which engines are subject in practice.

In all of the public turbine tests to date, with one exception, the output was measured through the electric power of a dynamo whose efficiency is not given for the range of loading employed, so that the average brake horse-power is not known. This exception is the Dean & Main test of a 600-h.-p. Westinghouse-Parsons turbine using saturated steam at 150 lb. pressure, and a 28-in. vacuum. We may compare the results of this test with that of the 850-h.-p. Rice & Sargent engine, and the 250-h.-p. Belgian engine, by assuming that the power absorbed by friction in these engines is 3 per cent. of the indicated load plus the power shown by friction cards taken with the engine unloaded. The latter showed 5 per cent. of the rated power in the case of the Rice engine and 8 per cent. in the Belgian engine; so that the assumption regarding the load friction is a reasonable one.

The results are given in the table, which shows the average water consumption per horse-power, for from 40 to 125 per cent. of full load, to be 14.55 lb. and 14.64 lb. for the two piston engines, and 14.51 lb. for the turbine, or practical equality:

Average Steam Consumption per Brake Horse-power of Piston Engine vs. Turbine.

	Lbs. water per B. h.-p.-hr.		
Per cent. of full load	600-h.-p. turbine.	850-h.-p. Rice eng.	250-h.-p. Belgian eng.
125	13.62	13.78	15.10
100	13.91	13.44	14.15
75	14.48	13.66	13.99
41	16.05	17.36	15.31
Ave.....85	14.51	14.56	14.64

As an indication of the gain in economy of the turbine with increase of size, we may use the Elberfeld test of a Parsons turbine at the full load of 1,500 e.h.p., with an allowance of 5 per cent. for attached air pump, and an assumed minimum generator efficiency of 0.95. Its saturated steam consumption, with 150 lb. boiler pressure and 28 in. of vacuum, is then 13.08 lb. per brake horse-power-hour, which shows a gain of 4 per cent. over the 600-h.-p. machine.

The 5,400-h.-p. Westinghouse compound engine at the New York Edison station, whose friction under full load was cleverly determined at about 4 per cent., affords a brake horse-power consumption of 12.5 lb. for 185 lb. boiler pressure. Crediting the turbine, therefore, with the possible influence of the difference in size and steam pressure, there is again practical equality in economy between it and the piston engine for equal horse-power.

Development of Pumping Engine Economy.—While the mill and electric practice has developed the compound engine, pumping engines in the United States have been developed in the triple-expansion flywheel type to a degree of economy superior to that afforded by any compound mill or electric engine, and, for saturated steam, superior to that of the pumping engines of any other country. This is because their slow speed permits of greater benefit from jackets and reheaters and of less losses from wire-drawing and back pressure. These causes, together with the greater subdivision of the range of cylinder, have resulted in records made between 1894 and 1900 of 11.22, 11.26, and 11.05 lb. of saturated steam per indicated horse-power, with 175 lb. steam pressure and from 25 to 33 expansions, in the cases of the Leavitt, Snow, and Allis pumping engines, respectively, the corresponding heat consumptions being by different dispositions of the jacket drainage, 204, 208, and 212 thermal units per indicated horse-power-minute; while later the Allis pump, with 185 lb. steam pressure, has lowered the record to 10.33 lb. of saturated steam per indicated horse-power, with 196 heat units of consumption per horse-power-minute.

The turbine can compete with these pumping engines only through the medium of a multiple-stage centrifugal pump, whose efficiency, taken even at 80 per cent., will probably impose too great a loss of motive power on the turbine system for successful competition with this high-class of piston pump, since the friction loss of the latter is only 5 per cent. of the indicated horse-power.

Gain from Superheating.—For opening the way to the improvement of the economy of the piston steam engine beyond any degree represented by the results we have thus far presented, we must make our bow exclusively to the Germans. By their revival of the use of superheated steam, after it had been twice abandoned in the history of steam engineering, they have demonstrated the practical success of superheating to raise the economy of any engine, whatever its boiler pressure or ratio of expansion, by rendering the steam a more efficient working medium on its entry to the engine. By showing that after the steam has been expanded to its greatest practical limits in piston engines an important amount of power can still be practically abstracted from it in the sulphur dioxide engine they have also reduced the waste accompanying its exit from the engine.

Previous attempts to use superheated steam failed because of the lowered efficiency of the boiler through the location of the superheating device in the chimney. Here the superheater was so arranged that the exit temperature of the heated gases had to be in excess of the superheated steam temperature to such a degree that the boiler's economy was lowered; and also the superheating surface so located and in contact only with steam was rapidly corroded. These defects the Germans have overcome by arranging the superheater so that it receives wet steam at the chimney end of the system, and lies at the middle of the flame current at the point where the superheated steam is delivered from it to the engine. Thus the hot gases can enter the chimney at no higher temperature than is consistent with the best economy from saturated steam boilers, and experience thus far shows no impracticable rate of depreciation of the superheater from corrosion.

The difficulty of conveying highly superheated steam from the boiler to the engine without excessive loss of temperature has also been overcome by improved and thicker pipe installation and the use of about half the pipe section usually employed for saturated steam. The generator plant has therefore been perfected so that it does not handicap the value of the superheated steam to the engine, while the latter is adopted to work the steam without lubrication difficulties by the use of poppet valves on at least the initial cylinder.

The maximum of improvement in economy

over saturated steam may be briefly summarized in the following extract from an admirable investigation by the most distinguished European authority on engine tests, Professor Schröter, of Munich: The engine used was the compound 250 h.-p. 13x21x33-in. Belgian Van den Kerchove construction, previously mentioned, operating with a boiler pressure of 130 lb., and 27.6 in. of vacuum, with 30.18 in. of barometer. For saturated steam the average water consumption for five divisions of load, between 40 and 125 per cent. of rated load, is 12.45 lb. per English indicated horse-power-hour, with 3.6 per cent. of steam condensed in the high jacket at 130 lb. pressure, and 9 per cent. in the low jacket, including the receiver, at 5 lb. pressure. Assuming the jacket drainages applied to heat the feed water from a temperature of 108° in the hot well, 136° Fahr. feed temperature would be afforded. Reckoning the expense of heat from this temperature, the consumption is 225 thermal units per indicated horse-power-minute.

With steam superheated 224° Fahr. above saturation, or at 304° Cent., the average consumption for the same divisions of load is 10.09 lb. of feed water per horse-power. With one-third of 1 per cent. high jacket and 3 per cent. low jacket and receiver consumption, the jacket water would heat the feed water to 115° Fahr. at the same hot-well temperature. Reckoning from this temperature, with a specific heat value of 0.6, according to the experiments of Lorenz and of Bach, the heat expense is 209 thermal units per horse-power-minute. The average gain by superheating 224° Fahr. is therefore 7 per cent. If the feed water were heated to 200° by auxiliaries, the heat unit gain would be 8 per cent.

With steam superheated 307° Fahr. above saturation, or at 350° Cent., and the load at about 80 per cent. of rating, the water consumption was 8.99 lb. per English horse-power, with 0.4 of 1 per cent. condensation in the high jacket and 4 per cent. in the low. This affords 114° Fahr. temperature, and with a specific heat of say 0.57 (since according to Lorenz's experiments the specific heat reduces with increase of superheat at any given pressure), we have a heat consumption of 192 thermal units per horse-power-minute. The same load with saturated steam affords 137° Fahr. of feed temperature and gives 221 units of heat consumption per horse-power. The gain for 307° superheating over saturated steam for the same horse-power is therefore 13 per cent. from the natural feed temperature, and for 200° feed, 14 per cent.

The best performance reported for superheated steam used in the turbine is that of Brown & Boveri Parsons Frankfort 4,000-h.-p. machine, which, with 183 lb. boiler pressure above the atmosphere and 190° Fahr. superheat, afforded 10.28 lb. per brake horse-power, assuming a generator efficiency of 0.95. Reckoning from the feed temperature of its vacuum of 27.5 in., and using a specific heat value of 0.65, the heat consumption is 214 thermal units per horse-power-minute.

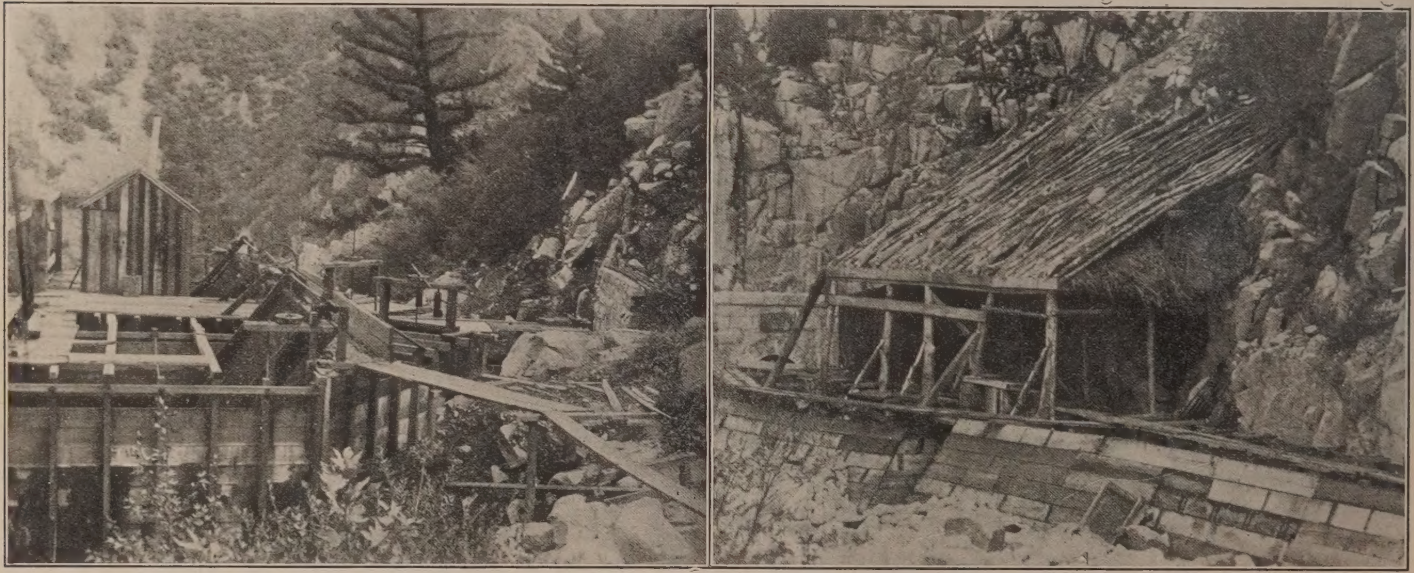
The heat consumption of the 250-h.-p. Belgian compound engine per brake horse-power at the highest superheating of 307° Fahr. is 220 thermal units. The turbine, therefore, probably holds the record for brake horse-power economy over the piston engine for superheated steam by a margin of about 3 per cent., although had the compound engine been of the same horse-power as the turbine, so that its friction load would be only 8 per cent. of its power instead of the 13 per cent. here allowed, it would have excelled the turbine in brake horse-power economy by a margin of about 2.5 per cent.

The Sulphur Dioxide Addenda.—The most economical piston engines, which, as we have seen, expand steam about thirty times, release their steam at the end of the stroke at about 6 lb. absolute pressure, but they exhaut into a condenser, which, with a vacuum of 28 in., contains a pressure of about 1 lb. absolute per square inch. If the expansion could continue until the pressure of 1 lb. was attained before exhaust occurred, considerable more work could be obtained from the steam. This, however, cannot be done in piston engines, for two reasons; first, because the low cylinder would have to be about five times greater in volume, which is commercially impracticable; and, second, because the velocity of exit through the largest exhaust ports possible is so great that the frictional resistance of the steam makes the back pressure from 1 to 3 lb. higher than the condenser pressure in the best engines of ordinary piston speed.

All the work due to this extra expansion can be obtained, however, by exhausting the steam from the low cylinder at 6 lb. pressure, against a nest of tubes containing liquid sulphur dioxide, which thereby is boiled to a vapor of about 170 lb. pressure. This can be used to drive the piston of a separate engine or an extra cylinder attached to the main engine, and be thence exhausted into a condenser to be reliquefied. If the sulphur dioxide expands in its cylinder to a pressure corresponding to its temperature of liquefaction, and the latter is that of steam at 1 lb. pressure, the work derived from the fluid is the same as the extra work which the steam would have furnished in the main cylinder by continuing to expand to 1 lb. pressure and exhausting against 1 lb. of constant back pressure. The greatest vacuum required in this system does not need to be more than 20 in., which is very easily produced and maintained, as compared with a vacuum of 28 in., corresponding to 1 lb. of absolute pressure.

Professor Josse, of Berlin, has perfected this sulphur dioxide system of improvement, and reliable tests have shown that if cooling water of 65° Fahr. is available, and to the extent of about twice the quantity usually employed for condensing steam under 28 in. of vacuum, a sulphur dioxide cylinder of about half the size of the high pressure cylinder of a compound engine will do sufficient work to improve the best economy of such engines at least 15 per cent. The steam turbine expands its steam to the pressure of its exhaust chamber, and as unlimited escape ports can be provided from this chamber to a condenser, it follows that the turbine can practically expand its steam to the pressure of the condenser. Therefore a steam turbine attached to a piston engine to operate with the latter's exhaust should effect the same saving as the sulphur dioxide cylinder, and turbines are being applied for this purpose at present by the makers of the Rateau type.

The turbine, therefore, even at this early period of its history, is already a formidable competitor to the piston steam engine in its most economical degree; and that it is so is mainly due to the fact that with no more waste in its steam action from internal friction than is due to the cylinder-wall wastes of the piston steam engine which are absent in the turbine, it more completely realizes the expansive principle enunciated in the infancy of steam history as the fundamental factor of economy, by its sagacious founder, the immortal James Watt.



Santa Ana Plant 1: Automatic Leaf Rake at Sand Box; Protecting Shed at Intake.

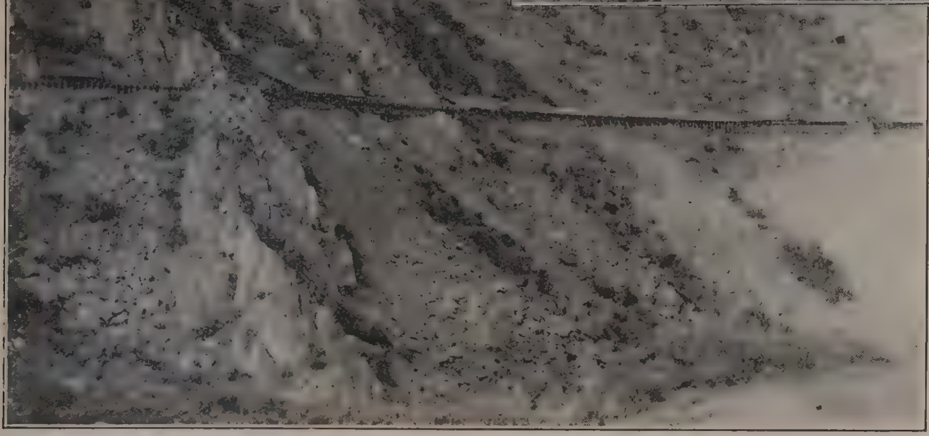
Steam for Residence Heating in Detroit costs 47 cents per 1,000 lb. of condensed steam, which is said to be 25 cents per square foot of radiating surface per season.

The Power Plants of the Edison Electric Company, of Los Angeles.—I.

The Edison Electric Co., of Los Angeles, is operating or carrying on development work in seven counties of Southern California. The company's extensive system at the time of writing embraces four water and three steam stations now supplying power, three water-power plants nearing completion, with seven more projected, and 600 miles of transmission and distributing lines which supply current for light and power purposes to over twenty cities and towns. The territory which it has been developing extends from the Kern River on the north to the Santa Ana River on the south. The streams on which it has rights are the leading rivers and creeks flowing down the westerly slope of the Sierra Nevada Mountains and the Sierra Madre Mountains between the limits above stated. The most important of these streams are the Kern River, the Santa Ana River, Mill Creek and Lytle Creek. The Kern River is the largest of these streams, but the Edison Company began its hydraulic power development and instituted much of the pioneer hydro-electric work of the West in connection with the Santa Ana River and other streams mentioned.

Santa Ana River Plant No. 1.—The watershed of the Santa Ana River is approximately 172 square miles in area. The flow of the stream ranges from 20 cu ft. per second minimum to as high as 1,000 sec. ft. during floods. The ordinary summer flow of the stream may be stated at about 40 sec. ft., while the average throughout an ordinary year, which can be devoted to power purposes, would be about 60 sec. ft. On Bear Creek, a tributary of the Santa Ana River, which enters the stream at the intake of the No. 1 plant, is located the Bear Valley reservoir. This reservoir, which is formed by the Bear Valley dam, has a capacity of 9,750,000,000 gal. of water and serves to equalize the flow of the stream throughout the year.

Flume Connecting Tunnels 8 and 9, Santa Ana Plant 1.



The 1,100-Ft. Flume of Santa Ana Plant 1.

The intake of the No. 1 plant is, as stated, at the junction of Bear Creek and Santa Ana River. The power house is situated three or four miles further down. The diversion of the water is made by means of two flumes; one on Santa Ana River and one on Bear Creek, which unite in a tunnel known as Tunnel No. 1. An accompanying view shows the mouth of this intake tunnel and also a rock shed protecting a gate in the flume. From that point down the conduit consists of 18 tunnels, which are driven through the various spurs along the mountain side. Between these tunnels are a number of flumes which span the various canyons intervening. One of the photographs herewith reproduced shows No. 8 flume connecting tunnels Nos. 8 and 9, and another picture is a view of a 1,100-ft. flume, the longest on the line. The total length of the tunnels is 12,040 ft.

The dimensions of these tunnels are as follows: Net inside width, 4.5 ft.; depth of water-carrying cross-section, 6.5 ft.; distance from water carrying cross-section to top of arch, 2.1 ft. The carrying capacity of the tunnels is 120 sec. ft. of water, which will produce at the power station about 6,000 h.p. The capacity of the flumes on the line is the same as that of the tunnels.

In addition to the line of tunnels and flumes above described, the hydraulic equipment of this station includes a sandbox, constructed substantially of redwood timber on concrete piers, for the purpose of precipitating sediment carried by the water. This sandbox has two parallel hoppers, with sluice gates in the bottom through which the silt is expelled into the canyon below. The sluicing of the sandbox can be executed while the plant is in operation, as the water will pass through one hopper while the other is being emptied. One of the views shows the automatic leaf-rake, which is located at the sandbox and operated by a small waterwheel in the tunnel below.

At the lower end of the gravity conduit is a concrete forebay, from which a steel-riveted force main, 30 in. in inside diameter, leads to the power house. Provision is also made for another force main of the same size, and this is now in course of construction, a considerable portion of the pipe for it being already on the ground. The length of the force main is 2,210 ft., and the total fall from the forebay to the power house is 728 ft.

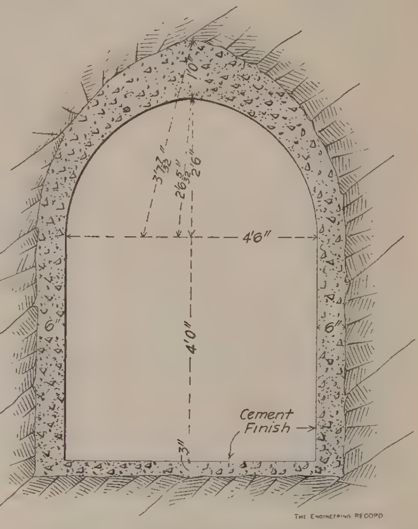
An ingenious float gauge has been arranged at the head of the Santa Ana River No. 1 pressure pipe to indicate at the power house the height of water in the forebay above. The arrangement is illustrated in two of the accompanying engravings. A bicycle wheel minus the rubber tire has been mounted on a horizontal axle and a rope passed around its rim one and a half turns. On one end of the rope is a float in a standpipe, in which the water stands at the level of water in the forebay. A weight at the other end of the rope hangs free and serves as a counterbalance. The raising and lowering of the float due to variation in the water level turn the wheel, to which is rigidly connected the resistance arm of a rheostat mounted behind the wheel. The rheostat is connected in circuit with a voltmeter on the switchboard at the station, and the voltage varies directly with the resistance. The dial of the instrument is calibrated in inches of water so that the station operator can tell instantly how much water he has in the flume above, and regulate his wheels and nozzles accordingly.

The water at the head of the pressure pipe can be shut off when necessary by means of a boiler-plate gate operating in brass slides. This gate is operated by a hydraulic ram by means of oil pressure, and the arrangement is illustrated in one of the views. Crude oil is pumped into the ram by means of the hand pump shown at the lower right-hand corner, the oil being taken from a small tank under the pump. The ram and gate are then moved by throwing the hand lever. The ram is shown at the left in the picture.

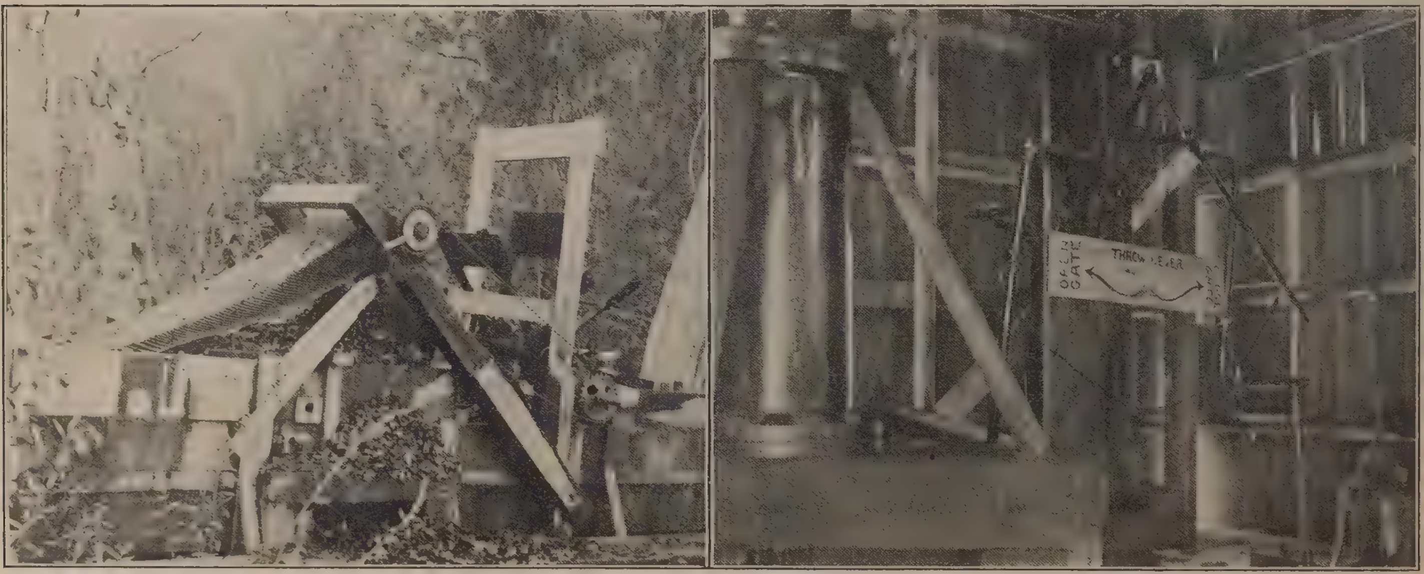
The plant is equipped with four 750-kw. 750-volt three-phase General Electric generators, each mounted on a three-bearing frame with a Pelton water wheel. The latter is supplied with a single nozzle of the deflecting type, under a static head of 728 ft. and an effective working head of 700 ft. The plant is arranged for two pipe lines. All the machines can be supplied from one line or the plant can be divided into two separate hydraulic plants for convenience in making repairs to either portion. There are three exciter units of 30 kw. each, direct connected to Pelton water-wheels.

Santa Ana River Plant No. 2.—Power plant No. 2, in Santa Ana canyon, diverts its water from the tail race of Power Plant No. 1, and will deliver it to a power house located about two miles further down stream at the head of what is known as the "Old Santa Ana Canal." The first structure consists of a settling chamber at the end of the 300-ft. tail race of Station No. 1, from which runs a 40-in. steel pipe under the bed of the Santa Ana River, in the form of an inverted siphon, 440 ft. long, to the opposite side of the canyon. Along that side of the canyon has been driven a line of eleven separate tunnels, aggregating in length 7,517.46 ft. This covers the entire line of the conduit, except an inverted siphon across what is known as Dirt Canyon, a flat ravine that cannot be crossed except by a high trestle or an inverted siphon; the latter form was adopted as being preferable. This siphon is a double line of steel pipe, 44 in. inside diameter, each line being 377.94 ft. long.

The tunnels are 4½ ft. wide inside of the concrete work, and have a depth for water-carrying cross-section of 5 ft. The tunnels are concreted throughout, both sides and bottom, and plastered with a smooth coat of cement plaster. Wherever the formation overhead is not continuous rock which is self-supporting, the tunnels are arched with concrete above the water-carrying cross-section. The carrying capacity of these tunnels, and siphons as well, is given as 100 cu. ft. per second of water. A cross-section of the latter type of tunnel is shown in an accompanying drawing; where the concrete roofing was not necessary, the sides were stopped at the springing lines, the excavated sections being the same. In addition to the main conduit there are two subsidiary siphons, which deliver the waters of the two tributaries on the opposite side of the stream into the conduit. These tributaries are known as Keller Creek and Alder Creek, and the siphons are known by the same names. Each siphon is of riveted steel pipe, 10 in. in diameter, and they are 895 and 857 ft. in length.



Tunnels of Santa Ana No. 2 Plant.



Automatic Leaf Screen and Hydraulic Gate Mechanism in Plants of the Edison Electric Co. of Los Angeles.

The inlet chamber at the end of the tail race of No. 1 plant and the upper end of siphon No. 1 is of concrete construction. It is 25 ft. square on the inside and 5 ft. 7¼ in. deep, with 6-in. concrete floor and 12-in. walls. The gate is in one corner of the chamber, and at the end of the tail race, which is 5 ft. 6 in. wide and 4 ft. 7¼ in. deep. The gate is raised by two cast-iron racks mating with pinions and driven by hand. The discharge from the inlet chamber is through a 44-in. pipe tapered to 40 in. in a distance of 10 ft. and set at an angle of about 30 deg. with the chamber wall.

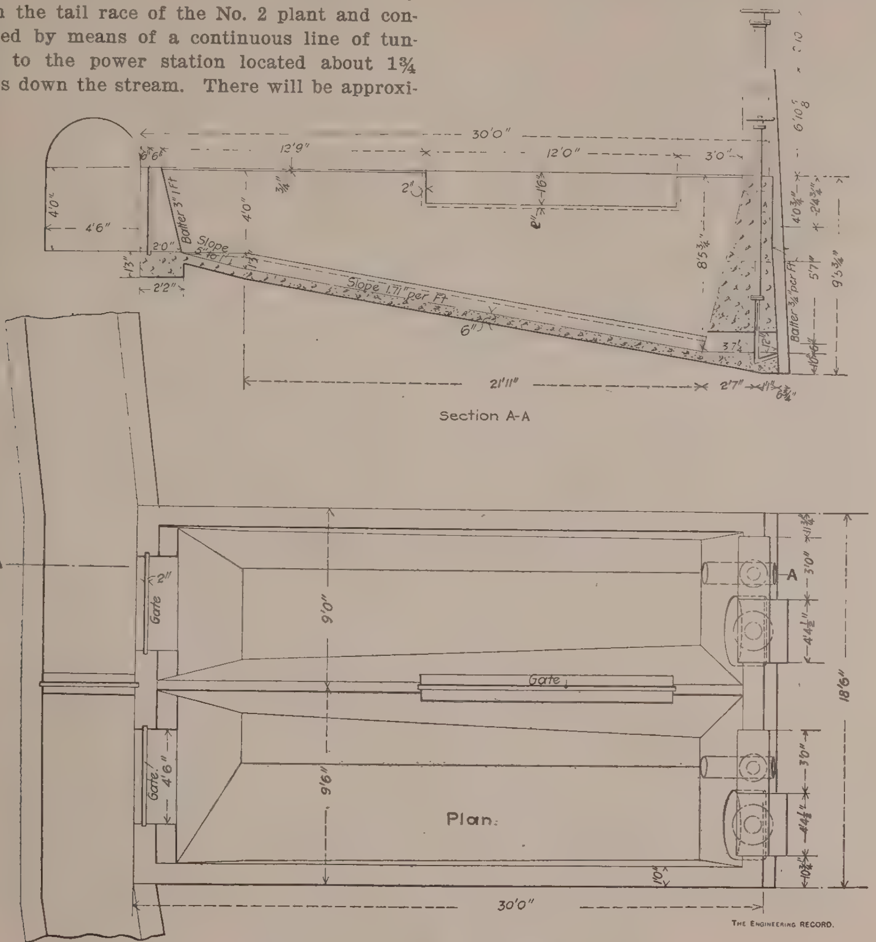
At the lower end of siphon No. 1 is constructed a sandbox, the subject of an accompanying line engraving, 30 ft. long and 18 ft. 6 in. wide, and having two hoppers or compartments through which the water must pass before entering the line of tunnels. This sandbox is provided with 12-in. sluice gates for sluicing out the sediment which collects, and is so arranged that the water may be passed through one side or hopper while the other is being emptied. The sandbox, as well as the lower end of Siphon No. 1, is located between Tunnels Nos. 1 and 2. Tunnel No. 1 is used only for diverting water directly from the stream, in the event of more water being desired for the plant than is at any time being carried through Power Plant No. 1. The sandbox is so arranged that water being diverted directly from the stream through Tunnel No. 1 can be passed through the sandbox and relieved of its sediment before flowing down the tunnels.

At the lower end of Tunnel No. 11 is constructed a large forebay, which serves to cut down very materially the velocity of flow before the water enters the force main. In this way any droppings from the roof of the tunnel, or sediment which might pass the sandbox at the headworks on a flood, are deposited, and can be sluiced out without passing through the force main.

The pressure main consists of 644.5 lin. ft. of 36-in. riveted steel pipe, having a thickness of No. 10 to No. 0 B. W. G. The force main, as well as all siphons, is provided with air valves, blow-offs, and an air chamber at the lower end of the main. A large 36-in. valve is placed in the pipe outside of the power house wall, by means of which the entire flow of water can be shut off at any time. Beyond this gate valve, and inside of the power station, the pressure pipe branches by means of a curved Y, from which the two units in the station are supplied. On the pipes from each branch of this Y are placed gate valves for shutting off the water supply to each unit, so that one may be closed and the other still remain in operation. The fall of water through the No. 2 force main is 310 ft., which will give an output of power from this plant of something over three-sevenths of that which is obtained from Santa Ana River Plant No. 1. The equipment is to comprise three 250-kw. 750-volt three-phase generators directly driven by Abner Doble water-wheels and stepping up to 33,000 volts to feed into the high-tension transmission system.

Santa Ana River Plant No. 3.—Santa Ana

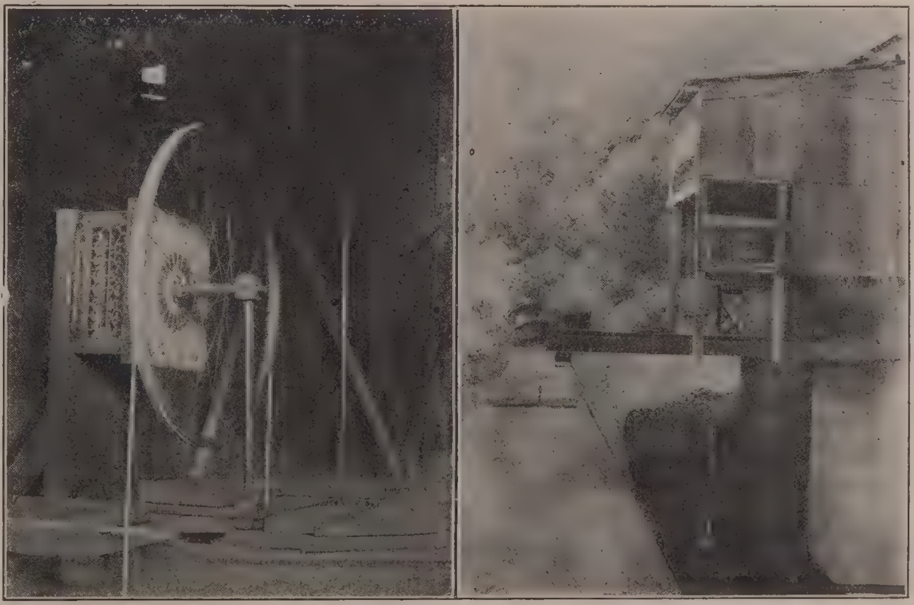
River Plant No. 3 has not yet been constructed, work having progressed, at the time of writing, only to the extent of completing Tunnel No. 1 and beginning the excavation of Tunnel No. 2. The water for this plant will be taken directly from the tail race of the No. 2 plant and conducted by means of a continuous line of tunnels to the power station located about 1¾ miles down the stream. There will be approximately 7,000 ft. of tunnel, and the net fall available for the power station slightly less than 300 ft.



Sand Box of Santa Ana Plant No. 2.

Santa Ana River Plant No. 4.—Power Plant No. 4 will have two hydraulic conduits; one from the Santa Ana River, with point of diversion about one mile above Seven Oaks, and the other from Bear Creek, with point of diversion at Corkscrew Falls. The power house site will be at the lower end of "Lost Man's Valley" on Bear Creek, which is a short distance above the intake of Santa Ana River No. 1. The fall available from the Santa Ana River branch will be about 1,000 ft., and from the Bear Creek branch about 2,200 ft. The construction of the plant has already been commenced. On the Santa Ana branch Tunnel No. 1 has been excavated, and Tunnel No. 2, which is over 1,200 ft. long, has already 800 ft. excavated. Work on the Bear Creek branch has been prosecuted by building a trail and road to the headworks, as this part of the country was wholly inaccessible before these improvements were made. The two lines of conduit together will carry the same amount of water as the other plants in Santa Ana Canyon, above described. No. 4 plant is being handled by the Union Power Co., which is a sub-corporation jointly owned by the Pacific Light & Power Co. and the Edison Electric Co.

Mill Creek Plant No. 1.—Mill Creek is one of the chief tributaries to the Santa Ana River, but flows through a less rugged canyon. The stream has a water shed of 60 square miles above the mouth of the canyon. The water shed varies in elevation from 3,000 ft. to 12,000 ft. The average flow for an ordinary year during the irrigating season is from 16 to 20 sec. ft. Mill Creek Plant No. 1 was constructed by the Redlands Electric Light & Power Co. in the year 1893. As originally built it employed a 30-in. steel force main which took the water directly from the stream and delivered it to the power house under a head of 377 ft. In the year 1896 the force main was extended upstream to the mouth of the canyon, adding 3,000 ft. of pipe and delivering the water under an increased pressure, making the total head 530 ft. The pipe ranges from No. 12 B. W. G. to 5/16 in. thickness at the lower end. The average output of Mill Creek Plant No. 1 is about 1,000 h.p. The plant was installed by Dr. Louis Bell, the late A. W. Decker and Mr. O. H. Ensign, electrical and mechanical engineer for the Edison company.



Two Views of the Float Gauge of Santa Ana Plant No. 1.

Mill Creek Power Plant No. 2.—The conduit for Mill Creek Plant No. 2 diverts its water from Mill Creek, at the junction of Mountain Home Stream and Mill Creek. It handles the water only which rises in the stream below the intake of No. 3, which is five miles further upstream, and the water of Mountain Home Stream. The line consists of 22-in. concrete pipe, which is laid through a number of tunnels and in trenches excavated along the side of the mountain, and of a number of flumes spanning ravines between the tunnels along the line. The plant was completed in September, 1899.

The intake consists of a tunnel projected into the gravel wash of Mill Creek and a shaft connecting this tunnel with the surface of the stream, by means of which the surface flow is diverted. The tunnel beneath the gravel bed of the stream draws out the underflow, and adds it to the surface flow. The intake shaft is provided with a screen made of T-rails, and has a movable gate for regulating the flow of water admitted. A concrete dam is constructed across the channel of the stream for turning the surface water into the shaft. Sand collecting above this dam is sluiced out by means of a sluice gate, while the sand which enters the shaft and tunnel is caught by the sandbox, which is located immediately below this tunnel.

The sandbox is 22x50 ft., and is divided into five compartments by means of concrete walls. It has a sloping bottom, being 5 ft. deep at the upper side and 9 ft. at the lower. The water may be delivered into any one of the compartments or carried entirely past the sandbox into the head of the pipe line. An accompanying reproduction of a photograph illustrates an automatic leaf screen at the headworks, which is driven by an undershot wooden wheel in the flume.

There were originally five tunnels, aggregating 2,010 ft. in length. Since the construction of the plant another tunnel has been added, 173 ft. in length, taking the place of a flume. At the lower end of the gravity conduit, consisting of 22-in. concrete pipe and redwood flumes, is a concrete forebay 20x17 ft. inside measurement, with a depth of 10 ft. at the lower end and 5 ft. at the upper end. The silt deposited in it is expelled through a sluice gate in the bottom.

The pressure pipe of this plant has a length of 1,411 ft. and a total fall of 627 ft. from the forebay to the power house floor. It is 18 in. inside diameter and of continuous riveted-steel pipe, having a range of thickness of from No. 14 to No. 0 B. W. G. The longitudinal seams are double-riveted and the circular seams single-riveted. To preserve the pipe against rust it was double dipped in asphaltum before being laid. It was covered in a deep trench so that no portion of it is exposed to the sun and elements. To prevent vibrations or sliding of the pipe line, it has been anchored at a number of places with heavy concrete anchors. These anchors are dovetailed into solid rock at the sides and bottom of the pipe trench. At the lower end of the force main there is located a large cast-steel Y, which branches the line into three different pipes. Two of these are 13 in. inside diameter and lead to the two generators for this plant; the third is a 6-in. pipe, supplying water for the two exciters. The force main is supplied with blow-offs, air valves and pressure gauges, and a large standpipe at the upper end. An air chamber is located at the lower end, near the station, to prevent water hammer.

The water from the tail race of the No. 2 and No. 3 plants is carried in a redwood flume across the channel of Mill Creek to connect with the intake of Mill Creek No. 1 pipe line. The overflow from the forebay of both pressure mains is carried in a flume of 2-in. redwood plank down to the channel of Mill Creek, from which point it flows into the No. 1 pipe line. The nozzles and tail races are all located underneath the floor of the station. The stream when deflected from the wheel, meets two deflector plates, which reverse it in a direction at right angles to the nozzle and then turn it parallel with the floor of the tail race in such a manner as to destroy the energy in the jet.

(To be continued.)

Tests of a Steam Pipe Covering.

Tests of a steam pipe covering of asbestos 1.53 in. thick and made in flat sections 3x2 ft. in size, wrapped around the pipe and laced with copper wire, were reported recently in "The Electrician," of London, from results obtained at the National Physical Laboratory, of which Mr. R. T. Glazebrook is director. The covering averaged 2 lb. weight per running foot or 1.7 lb. per square foot of the external surface of the 4-in. pipe used in the tests. The trials were conducted in a usual manner with a 14.34 ft. length of the pipe inclined 6 in. in this distance. The radiating surface of the pipe was 16.85 sq. ft. With a steam temperature of 392.7° and air temperature of 67.7°, the condensation of the bare pipe was 1.66 lb. steam per square foot per hour, and the heat loss 4.27 B.t.u. per square foot per hour per degree difference in temperature. With a steam temperature of 393.4° and air temperature of 64°, the condensation with the covered pipe was 0.212 lb. per square foot per hour, or 0.54 B.t.u. per square foot per hour per degree. It was calculated that the losses with steam pressures of 190, 200, 210 and 220 lb. by gauge were, for the covered pipe, 168.4, 170.6, 172.7 and 174.6 B.t.u., respectively, per hour per square foot, and, for the bare pipe, 1,339, 1,357, 1,373 and 1,389 B.t.u., respectively.

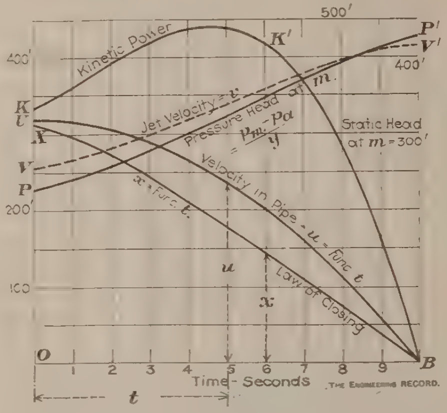
A Gasometer of 5,280,000 cu. ft. capacity is said to be nearing completion at the gasworks of the Imperial Continental Association at Mariendorf, near Berlin.

The Governing of Impulse Wheels.

By Irving P. Church, C. E.

In view of a recent article by Prof. Goodman published in London "Engineering" (issue of Nov. 4, 1904) on the governing of impulse water wheels, some further discussion of the matter has suggested itself to the present writer. The water for the wheel is supposed to be conveyed through a long supply pipe terminating in a nozzle of some kind to form the "free jet." When the "load" or resistance overcome by the wheel changes, the governing apparatus is supposed to act and to vary the size of the jet by the movement of a valve (or regulating "needle," it may be, of the Pelton or Doble type). If the valve were completely closed and with a fairly uniform motion and the time so occupied, (according to the researches of Joukowsky of Moscow, of Rateau, Stodola, and others) were less than the result obtained by dividing twice the length of the supply pipe by the velocity of sound in water, the compressibility and elasticity of the water and the extensibility of the pipe itself would be brought into play, and a dangerous bursting pressure induced in the water in the pipe; unless relief valves or a large overflow stand pipe were provided.

But with most installations these extreme conditions do not arise and the increase of pressure in the pipe as due to the partial closing of the valve may be considered as mainly due to the interruption of the condition of "steady flow" or "state of permanency" of the water in the pipe; since the water tends to "bank up," as it were, at the base of the nozzle, and neither the elastic compressibility of the water, nor the distension of the pipe, is brought into play to any appreciable extent.



Properties of Water Jets.

Now Prof. Goodman seems to have overlooked entirely this vital point in the problem, viz., that with a long supply pipe the hydraulic conditions are no longer those of "steady flow" when the valve is in motion. The relations on which his analysis is based are evidently founded on the supposition that the flow is steady at all times during the motion of the valve, and must therefore, in the opinion of the writer, be regarded as unsound for the purpose in hand.

Theoretical investigations in this connection have been made by Mr. B. F. Latting and the present writer (Journal of the Franklin Inst., April and May, 1890; Transac. Assoc. Civ. Engs. of Cornell University, 1898, p. 31), and were supplemented by experiments conducted by Mr. Latting at Ithaca, N. Y., in 1894. In these investigations fluid friction was considered. Mr. Latting's experiments were made with a pipe 8 in. in diameter and 2,395 ft. in length, leading out from a large stand pipe and fitted at the lower extremity, 302 ft. below the surface of the water in the stand-pipe, with a nozzle the jet from which was round and two inches in diameter when its valve was fully open (crescent-shaped at other stages). These experiments afforded a fair confirmation of the theoretical treatment.

The whole time of closing the valve was 26 seconds (after a steady flow had once been inaugurated). The "law of closing," or rate at which the size of jet was diminished, was not far from uniform but was made to follow a definite relation which lent simplicity to the mathematical theory. As already stated, the static head was 302 ft., corresponding to a pressure of 131 lb. per sq. in. (above the atmosphere). The pressure in the 8-in. pipe near the nozzle during the preliminary steady flow was 107 lb. per square inch above the atmosphere, and at the end of the time of closing of the valve had risen to its maximum of 143 lb. (theory giving 139). In a second experiment the final pressure was 144. According to Prof. Goodman's treatment of the problem the final pressure would not exceed the static pressure.

The pipe was made available for Mr. Latting's purposes through the kindness of the officers of the Ithaca Water Works Co.; but owing to the limited time in which it could be used, only two experiments were made. The results of experiment gave a fair confirmation of the theory, when the difficulties encountered are considered; among which was that of a proper control of the motion of the valve to make it accord with the prescribed "law of closing." This special "law of closing" was of such a nature as to cause the velocity of the water in the supply pipe to be uniformly retarded, the strict securing of which would have necessitated an instantaneous movement of the valve at the very outset through a small finite portion of its range. Of course this could only be approximated to; and for this reason, since the motion of the valve had therefore to be a trifle quicker than theory required in the latter part of the time of closing, the final pressure doubtless reached a slightly higher figure than would otherwise have been the case.

It may be of interest to present, with the aid of a diagram (permission to reproduce which has been given by the Assoc. of Civ. Engs. of Cornell University; from their Transactions, p. 41, 1898) the theoretical results obtained in a case where the data do not differ very greatly from those in Mr. Latting's experiments, but one in which the retardation (or negative acceleration) of the water in the supply pipe is gradually and uniformly increased from a zero value (which it has for the preliminary steady flow) at such a rate that at the end of ten seconds the valve is entirely closed and the velocity in the pipe zero, viz.:

Length of supply pipe 3,220 ft., and diameter 8 in. Head from reservoir surface to nozzle, 300 ft.; size of round jet issuing from nozzle, 2 in. diameter during steady flow and at the beginning of motion of valve; valve to be closed in ten seconds of time and to be so controlled in its movement that the reduction of velocity of water in pipe shall be proportional to the square of the time (see curve UB in diagram; parabola, vertex at U. The ordinate represents the velocity, u, in the pipe at any instant during the ten seconds of closing; the abscissa representing the time, t; any portion of the ten seconds). This necessitates a "law of closing" shown by the ordinate x of the curve XB. For example, at the end of the fourth second $x = 0.646$ of its initial value $x_0 = XO$; i.e., the sectional area of the jet is, at the end of the fourth second, 0.646 of its original value (or area of a 2-in. circle). Use being made of Fanning's table of values for the coefficient of fluid friction for clean cast-iron pipes, the velocity of steady flow in the pipe when the valve is fully open is found to be $u_0 = 6.4$ ft. per sec., represented by UO in diagram, and the pressure-head at end of pipe near nozzle (at a point, m, however, where the diameter is the full eight inches) to be 225.8 ft., above the atmos., (the static head is 300 ft., at that point). The curve PP′ shows by the variation in its ordinate the increase of pressure-head at m (above the atmosphere) during the ten seconds of closing; from its initial value of 225.8 ft. to its final and maximum value of 427 ft. This final value is seen to be almost double that obtaining during steady flow and some 42 per cent. in excess of the static head.

The velocity, v, of the water in the jet itself (see ordinate of the curve VV′) is seen to increase steadily from its initial value, which is $v_0 = 102$ ft. per sec. (same as during the preliminary steady flow) the jet being then two inches in diameter, to a final maximum of 165.8 ft. per sec.

Of course, the quantity of water flowing per sec. (Q cu. ft. per sec.; proportional to the product xv) decreases with the progressive closing of the valve; but the "*Kinetic Power*" of the jet, [that is, the quantity (mass per sec.) $\times v^2 \div 2$, which is proportional to Qv, or xv^2,] on being computed and plotted for several points is seen to give ordinates of a curve, KK′, whose maximum ordinate is reached at about four and a half seconds from the start. If, then, the object of partially closing the valve were to decrease the kinetic power of the jet, it is evident that the very contrary effect is produced during the first seven seconds in the present case.

It is worth while, however, to look more minutely into the action of the jet on an impulse wheel during the closing of the valve, with the present data. Let us suppose that an impulse wheel has been utilizing the jet during the preliminary steady flow. During steady flow, the motion of the wheel being uniform, the buckets having a velocity of one-half v_0, the tangential force, P lb., of the water on the rim of the wheel has a moment about the shaft of wheel equal, of course, to that of the resistance, R lbs., (acting at the rim of a pulley keyed upon the same shaft). Let R now diminish in value; so that the governor acts and the valve begins to close in accordance with the law now considered. How will the value of the force P be affected during the first three or four seconds? If the wheel is not to "speed up," P should diminish as well as R, and in the same ratio; or the equilibrium of moments will be destroyed.

According to the mechanics of an impulse wheel P is proportional to $Q(v - v^1)$, where v^1 is the velocity of the bucket; i.e.,

$$P = Cxv(v - v^1) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where C is a constant.

At the beginning of the valve's motion P has a value

$$P_0 = C\,x_0\,v_0\left(v_0 - \frac{v_0}{2}\right) \ldots\ldots (2)$$

and let us suppose that the wheel is provided with such a massive flywheel that the velocity of the buckets will not differ materially from $v_0 \div 2$ during the first three or four seconds. Then the value of P at any time during the first three or four seconds will be expressed by the equation

$$P = C\,x\,v\,(v - 0.5v_0) \ldots\ldots\ldots (3)$$

Now by inspection of the curves for x and v it is evident that during the first three or four seconds the percentage increase in v is about equal to the percentage decrease in x, so that the product xv is diminishing very slowly; hence, as to whether P is very different from P_0 during this early part of the closing, depends mainly on a comparison between the factors $(v - 0.5v_0)$ and $(v_0 - 0.5v_0)$. An inspection of the diagram shows, roughly, that the former factor at the end of the fourth second is some 50 per cent. in excess of the latter, and we may therefore conclude that the working force P is increasing at the rate of about 12 per cent. each second, during the first four seconds of the closing.

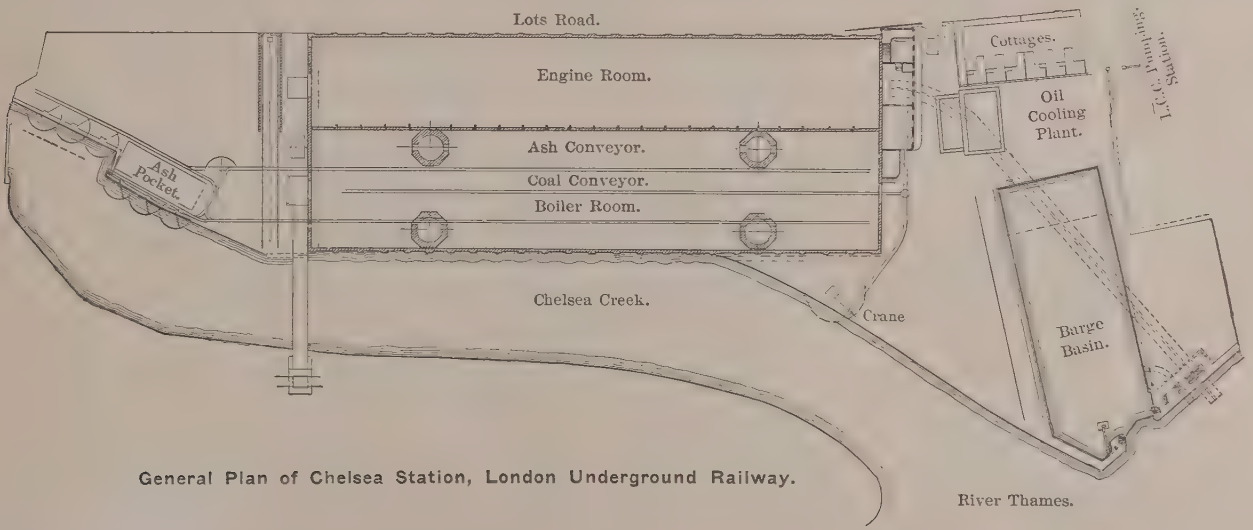
If, therefore, the wheel is not provided with a sufficiently massive flywheel, it will certainly "speed up" during the first part of the time of closing; probably during the first three-quarters of it. We are therefore led to the conclusion that without such a flywheel an impulse wheel under above circumstances would "speed up" as a result of the action of the governor, instead of maintaining a fairly uniform velocity; unless, as previously intimated, relief valves (or an open stand pipe; or air vessel) are provided to prevent any harmful rise of pressure at the end of the pipe.

With this latter provision the flow in the pipe would not vary much from a condition of "steady flow" during a partial closing of the valve and the motion of the valve, while causing a diminution in x, would at the same time cause a decrease in P, v remaining approximately constant.

THE POWER CONSUMPTION OF ELECTRIC LAMPS was summarized as follows by Prof. H. T. Davidge in a recent paper before the Junior Institution of Engineers: Incandescent lamps, 2¼ to 4½ watts per candle-power; enclosed arc lamps, 2½ to 4 watts; Nernst lamps, 1½ to 2½ watts; open-arc lamps, 0.8 to 1½ watts.

The Chelsea Generating Station of the London Underground Railways.

The Underground Electric Railways Co., of London, Ltd., was incorporated April 9, 1902, for the purpose of supplying and distributing power to a number of electric railways in London, and is under the control and management of Mr. Charles T. Yerkes. The various roads, including such parts of the Metropolitan District Ry. over which trains have running powers, as well as the relative location of the generating station and the 24 substatons included in the general scheme, were shown in a map printed in The Engineering Record of Dec. 31, 1904, in connection with a general account of the London underground railway system. The double-track mileage of the independent roads to be supplied with power is as follows: Metropolitan District Ry., 56.07 miles; Great Northern, Piccadilly & Brompton Ry., 10.41 miles; Charing Cross, Euston & Hampstead Ry., 8.02; Baker St. & Waterloo Ry., 4.45 miles; Edgware & Hampstead Ry., 4.70 miles. The longest continuous run is from Barking to Uxbridge, a distance of 29.73 miles, with an average distance between stations of 3,650 ft. The work in connection with the electrification of the railways is being executed under the direction and personal supervision of Mr. James R. Chapman, general manager and chief engineer of the company, and the following description of the power station has been obtained from information furnished by Mr. S. B. Fortenbaugh, electrical engineer of the company.



General Plan of Chelsea Station, London Underground Railway.

The site comprises 3.67 acres of land, with a frontage of 1,100 ft. and 824 ft. on the Thames River and Lots Road sides, respectively, the outline of the property and general arrangement of buildings being shown in the accompanying general plan. The main building is entirely of fireproof construction, without ornamental features, and consists of a self-supporting steel frame, weighing about 6,000 tons, enclosed with brick and terra-cotta. It is 453.5 ft. long, 175 ft. wide, 140 ft. in height from the ground floor to the peak of the boiler room roof, and is divided longitudinally by a brick wall. The inside widths of the engine and boiler room are 72.5 ft. and 96.5 ft. respectively. There are four chimneys built of Custodis brick, each 19 ft. internal diameter and 275 ft. high. Concrete, expanded metal and asphalt are used in the construction of the roof and all floors, other than the engine room, which is floored with checkered steel plates. The building is arranged for ten 5,500-kw. turbo-alternators and one split unit of 2,700 kw., a total normal full load capacity of 57,700 kw. On this basis there are 139 cu. ft. per kilowatt (including office building), and 1.36 sq. ft. per kilowatt.

The boiler room is designed for an ultimate equipment of 80 Babcock & Wilcox horizontal water-tube boilers, each boiler having 5,212 sq. ft. of heating surface and 672 sq. ft. of superheating surface. They are carried directly on the steel frame of the building, entirely independent of the brickwork, arranged two stories high, and are piped in groups of eight, with no steam connections between the several groups, except one supplemental header between two groups of supplying steam to the exciter engines, air compressor and house pump. With this exception, the main generators are arranged on the unit system, each unit consisting of one turbo-alternator and condenser, eight boilers and one boiler feed-pump. The working pressure is 175 lb. with 150° of superheat, the steam from each group being collected in one header and led direct to its turbine.

A large tank in the oil-cooling house is used for the storage of feed-water, this tank being supplied either from an artesian well on the premises or from the city mains. River water can be turned into a secondary suction pipe connected to each pump in the event of failure from both the above sources of supply.

The boiler feed-pumps are located on the basement floor and supply ring mains on both boiler room floors. While each pump has sufficient capacity for two groups of boilers, the arrangement is such that for test purposes one pump will supply the group from which its steam is obtained. Under normal conditions only alternate pumps will be in service. Each ring main header is supplied by two pumps and so arranged that either pump may supply either of two groups or both when the turbines are running on light load. Green economizers are installed, these being constructed with tubes further apart than the usual practice, and arranged in nests behind each group of boilers with the usual by-pass flues, 1,540 sq. ft. of heating surface being provided for each boiler.

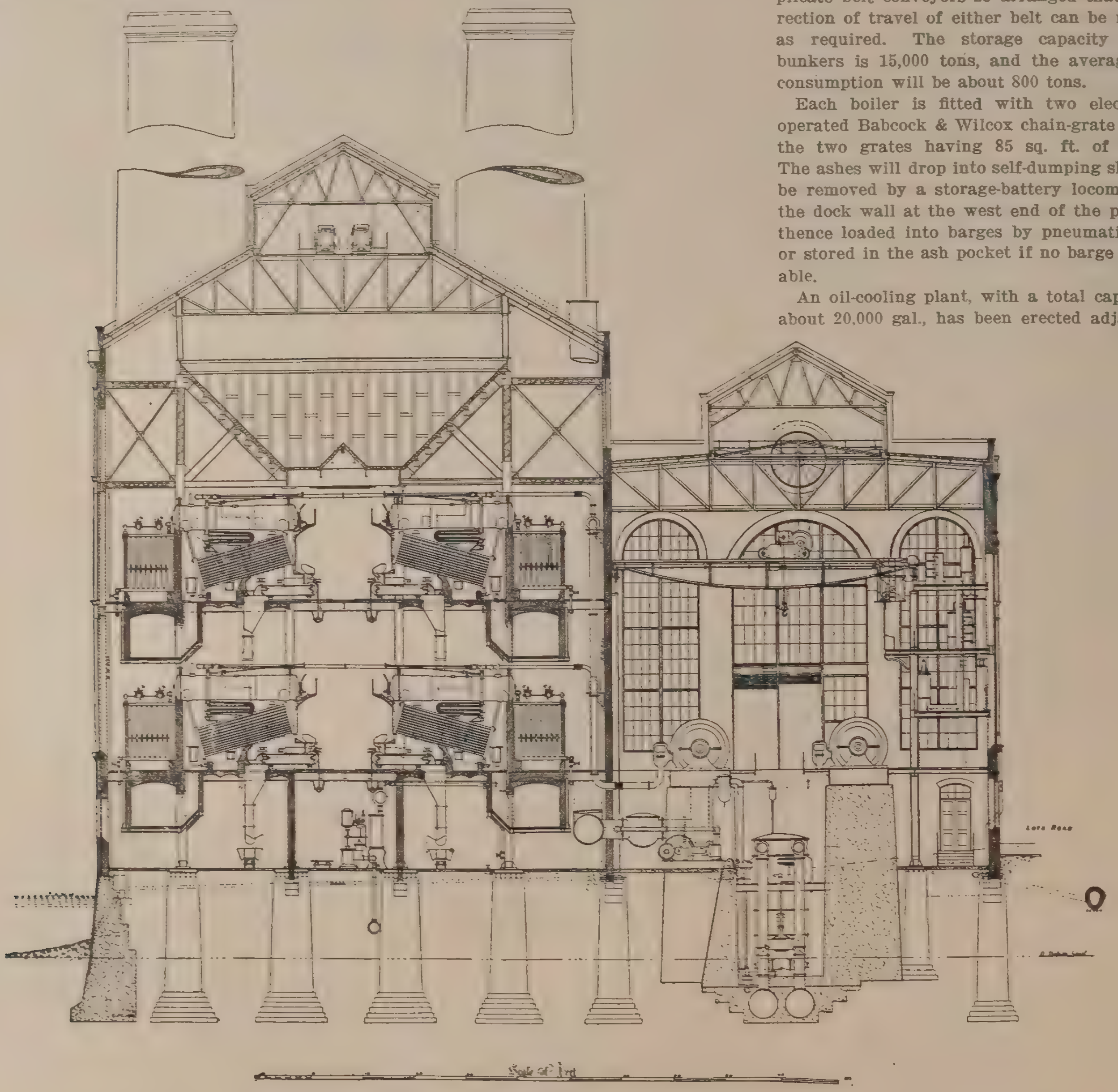
Vertical condensers, each with 15,000 sq. ft. of cooling surface, are located in pits between the engine foundations, and are designed to work on the dry vacuum principle, the air and condensed water pumps being separate. The circulating water is supplied by two 66-in. pipes, which extend to the edge of the Thames Channel, and are arranged on the syphon principle. The intake and discharge mains are further arranged for reversible flow, so as to dispose of any sediment which may collect, there being no screens at the mouth of the pipes to stop floating material.

Provision has been made for the delivery of coal either by barge or rail and at opposite ends of the building. Barge coal will be received at the east end of the building, unloaded by two traveling cranes spanning the large basin and weighed in the tower constructed on each of these cranes. From the weighing machines it falls on to the belt conveyor, passes through the coal crushers and is thence raised 140 ft. by duplicate inclined elevators to the coal conveyors in the top of the building. Rail coal will be taken from a hopper under the coal cars by an inclined elevator at the west end of the building, and in either case the distribution over the coal bunkers is made by duplicate belt conveyors so arranged that the direction of travel of either belt can be reversed as required. The storage capacity of the bunkers is 15,000 tons, and the average daily consumption will be about 800 tons.

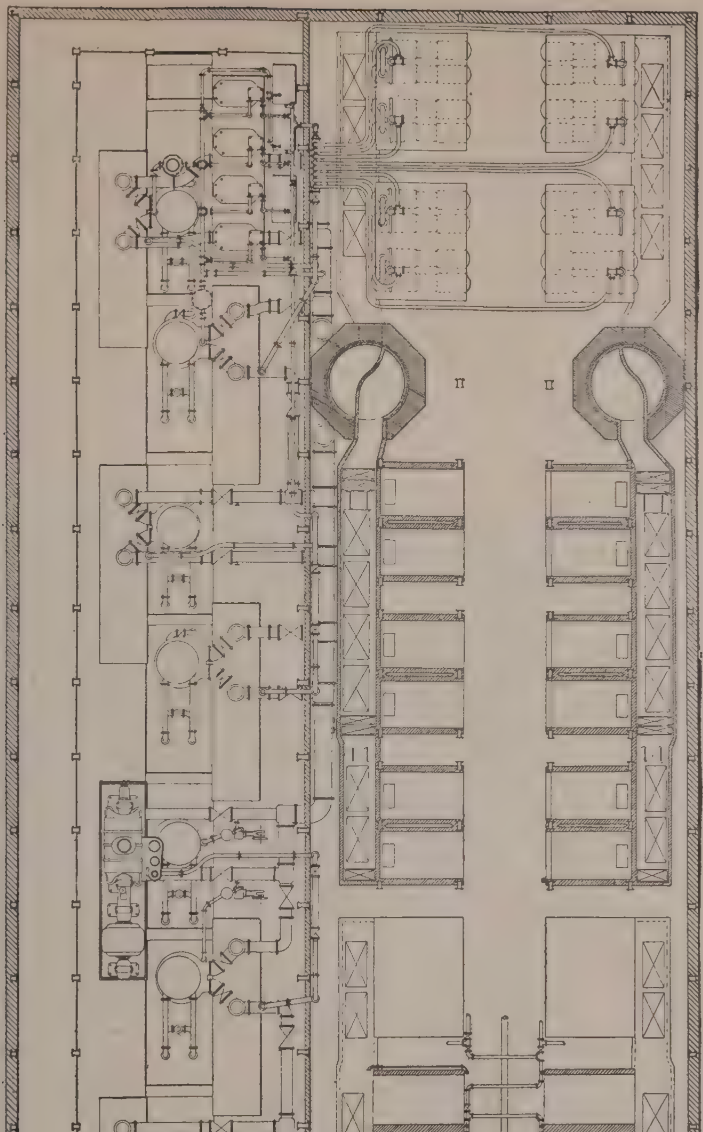
Each boiler is fitted with two electrically-operated Babcock & Wilcox chain-grate stokers, the two grates having 85 sq. ft. of surface. The ashes will drop into self-dumping skips and be removed by a storage-battery locomotive to the dock wall at the west end of the premises, thence loaded into barges by pneumatic hoists or stored in the ash pocket if no barge is available.

An oil-cooling plant, with a total capacity of about 20,000 gal., has been erected adjacent to the main building, and contains three coolers, each of which has approximately 686 sq. ft. of cooling surface. The oil flows by gravity from the storage tanks in the top of the oil house through the engine bearings back to a second set of tanks in the basement, and from which it is forced by centrifugal pumps, through the coolers, to the tanks located in the top of the building. The working capacity of this plant is 350 gal. of oil per minute, about 5 per cent. of which is by-passed through filters.

The turbo-alternators are of Westinghouse manufacture, and consist of a single-cylinder double-flow steam turbine direct connected to a



Cross-Section of Power Station of London Underground Railway.



Plan of Power Station, London Underground Railway.

rotating-field turbo-generator. The present installation will consist of eight units, the normal full load of each machine being 5,500 kw., with a guaranteed overload capacity of 50 per cent. for 2 hr. The coupling connecting the turbine and generator is of the flexible claw type of forged steel and runs in oil. This coupling, although transmitting the full power of the shaft, has sufficient latitude to allow the generator and turbine shafts to revolve about independent centers without the one affecting the other.

The turbines are designed to operate at a speed of 1,000 r.p.m. with a steam pressure at the throttle of 165 lb. and 100° of superheat. When operating under these conditions and exhausting into a vacuum of 26 in. and 27 in. of mercury, the stated approximate steam consumption per electrical horse-power-hour is as follows: One and one-quarter load, 16 lb. with 26-in. vacuum and 13.6 lb. with 27-in. vacuum; full load, 15.6 lb. and 13.2 lb., with 26 and 27-in. vacuum, respectively; three-quarter load, 17.2 lb. and 15.0 lb., and one-half load, 18.4 lb. and 16.0 lb.

The first series of blades are of drop-forged steel let into the dove-tailed grooves, and the low pressure blades are constructed of delta metal, so as to prevent any corrosion due to wet steam at this point. The steam entering at the center and flowing both ways will eliminate end thrusts and keep the shaft in equilibrium, but a thrust block is provided at the extreme end of the cylinder for the adjustment of the spindle relative to the cylinder. About 30 gal. of oil per minute will be supplied from the central gravity oiling system to the bearings of each machine, the bearings being provided with an emergency water-jacket requiring approximately 40 gal. of cooling water at 65° per minute.

The normal output of the alternators is 5,500 kw., or 289 amperes per phase of 11,000 volts on non-inductive load. The normal excitation current is about 180 amperes when the armature is delivering its full current with unity power factor.

The exciter engines are of the compound two-crank double-acting vertical-enclosed high-speed type with forced lubrication, and were supplied by Messrs. W. H. Allen, Son & Co. They are capable of indicating 200 h.p. with a steam pressure of 165 lb. and 100° superheat when exhausting into a condenser with a vacuum 4 in. less than the barometric pressure. They operate at a speed of 375 r.p.m. and are direct connected to British Thomson-Houston 125-kw. 125-volt compound-wound generators. Four of the above sets comprise the exciter system, three machines to be used for excitation only under normal conditions.

The auxiliary electrical installation includes one 125-kw. synchronous motor-generator set, nine single-phase 11,000-220-volt transformers, aggregating 1,500 kw., and two small 125-volt storage batteries. The motor-generator will be used primarily for charging the storage batteries and the supply of direct current for miscellaneous purposes. The transformers supply power to the motor-generator set and the 220-volt, three-phase induction motors operating the various pumps, coal-handling machinery, stoker mechanism, etc., the storage batteries supplying current for operating the oil-switch motors.

All the equipment for both the main and auxiliary switchboards has been supplied by the British Thomson-Houston Co., this apparatus being essentially of standard Schenectady design and construction. Only one set of main bus-bars are installed, but bus junction switches are used, so that it is possible for the main bus-bars to be divided into five sections and the generators operated in groups of two or all in parallel if desired. The feeder cables are in duplicate, and are so arranged that no two cables to the same sub-station are connected to the same set of feeder bus-bars, or—with two exceptions—to the same section of the main bus-bars. In no case are the cables to adjacent substations on the same group switch, and all duplicate feeder cables are, furthermore, symmetrically arranged on opposite sides of the center point of the main bus-bars. The generator and feeder instrument and control panels are located in the center of the house on the middle switchboard gallery, all high-tension switching and apparatus being controlled from this point.

Floating Docks.

No engineer is better known as a specialist in the design of floating docks than Mr. Lyonel E. Clark, and accordingly the following official abstract of a paper on the subject read by him on Jan. 31 before the Institution of Civil Engineers is believed to be of unusual value.

The paper deals with the floating dock as a method of getting at the under-water portion of ships, and the author points out that this appliance, although in common use, is less known in England than elsewhere, which he ascribes to the fact that the rise and fall of tides on the British coasts naturally favors the excavated form of dock, whereas in non-tidal waters, as he shows by statistics, the floating dock is equally as common as the other.

The simplest form of floating dock consists of a hollow pontoon, forming the buoyant or lifting portion, with two hollow side-walls on top of the same, forming the controlling portion of the system; to this the name of "box" dock has been applied. When built of iron, however, such docks required means of protection against rust and decay, and the self-docking principle was evolved. The first form of this consisted in constructing the box dock in such short sections that they could lift each other, and to this type the name of "sectional" dock has been given. Later, in order to avoid the use of the numerous small sections, a modification was introduced by which two sections of any length lifted a third section between them, by allowing it to rest on the projecting ends of their pontoons. Such "sectional" docks, however, presented no longitudinal rigidity whatever, and consequently another departure was made in which the pontoons only were built in sections, being bound together by continuous side-walls, and the self-docking operation consisted in removing any one pontoon from under the side-walls, and lifting it on to the rest of the dock. This type is known as the "sectional pontoon" dock. The longitudinal rigidity of this type, however, was not very great, and having the problem set them of lifting both long and short vessels of equal displacement on the same dock, the author's firm introduced, in 1895, a new type which is now known as the "Havana" type. In this, the continuous side-walls are on each side instead of on top of the pontoons, thus extending downwards to the full depth of the same, and forming strong girders, to the sides of which the pontoons are bolted. The self-docking of this type is carried out by unbolting the desired pontoon from between the side-walls, and docking it on the rest of the dock. Later still, when yet greater rigidity was required, the firm introduced a new form, known as the "bolted sectional" dock, this being an ordinary sectional dock, but with the different sections rigidly bolted together. The self-docking of this type is effected by so designing the end sections with points or projections, that these points can take under the square-ended central section and lift it, or alternatively, enter between the walls of the same when an end section is being lifted.

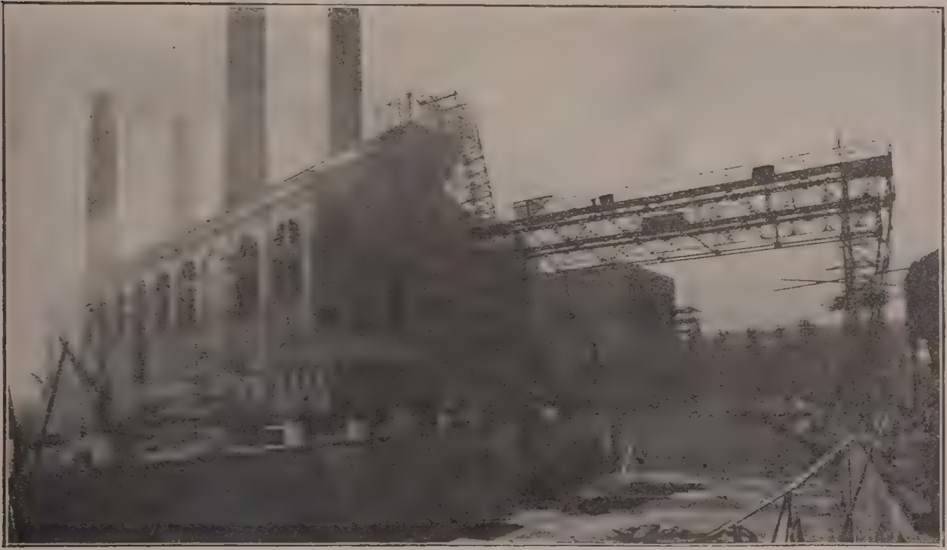
The author then proceeds to describe the one-sided types of dock. One is the "depositing" dock, in which the necessary stability is obtained by attaching the L-shaped dock to a floating outrigger by means of parallel hinged booms, the body or pontoon of the dock being built in the form of separate fingers. These fingers, which carry the ship, are floated in between similar fingers of pile work or masonry placed on the shore. The dock is allowed to sink, leaving the ship supported on this fixed staging, and the dock is then free to deal with other vessels. The other type, namely, the "off-shore" dock, has the pontoon as a continuous structure, and stability is obtained by connecting the dock, by means of parallel booms, to columns fixed in the foreshore, the top boom being connected to a weighted cam which allows the dock to heel slightly athwart-ships, so that its horizontality can be maintained by regulating the valves. Lastly, a combination of the foregoing two types is mentioned, wherein the continuous pontoon is used in conjunction with a floating outrigger, on which are carried the dock's boilers and any small repairing-shops and machinery required in connection with the dock.

The paper then passes on to the chief problems that confront the designer of a floating dock. The most important of these is the determination of the longitudinal strength required when carrying a short, heavy ship on a long dock; and closely analogous to this is also the determination of the strains to which a dock is subjected in a sea-way. The transverse strains due to the ship resting centrally on the dock are also treated, and different types of internal bracing are discussed, especially the design of that portion of the dock which comes directly under the ship's keel. Lastly, the local strains on the dock's structure due to water-pressure when submerged, and the working-stresses allowable under such conditions, are referred to.

The stability of a floating dock next engages the author's attention, and the ordinary method and rules employed are given, for the stability of a ship is governed by different conditions from that of a dock. In the former, the shape of the water-planes varies but slightly, but the angle of heel may be very great; whereas in the latter the shape of the water-planes is always varying, but the angle of heel permissible

General View in Engine Room of Power Station of London Underground Railway.

is so small that it can be virtually disregarded in its effects. The stability of a dock is, therefore, best expressed by means of a curve giving the metacentric heights at all states of immersion, from the time when it is sunk ready to receive a ship until the vessel is lifted, and the pontoon deck is above water. The method of calculating the stability of the one-sided types is also treated, showing how, in the case of the depositing dock, it is the floating outrigger which has to provide the righting moments, while in that of the off-shore dock, the weights on the regulating cams have to be arranged to give the required control.



East Elevation of Power Station, Showing Conveyor for Unloading Coal Barges.

The paper next proceeds to discuss the advantages and disadvantages of the floating dock as compared with the excavated dock. First, it is pointed out that the time required for constructing a floating dock is much less than that needed for the excavated dock, and instances are given of large docks having been completely designed and built in well under a year. The advantage of the mobility of the floating dock is then discussed, both from the point of view that this allows of its being built in the cheapest and most suitable yard and then towed to its destination, and also that in the case of alterations to its site, or development of the port where it is placed, it is not tied to such site or port, but may be bodily moved to any more suitable place. The advantage of mobility from a strategical point of view is also shown, and it is pointed out how such a dock would be useful in connection with any existing arsenals, which are naturally always placed at some distance from the sea, for it could be sent down the channel to pick up and patch "lame ducks" before they attempted the narrow passage leading to the arsenal. The author mentions that it has indeed been proposed that a floating dock should accompany a fleet into action, ready to pick up wounded vessels after an engagement, but in his opinion this is not yet a practical scheme, the difficulties of propelling such a dock even at ordinary cruising-speeds being insurmountable. At the same time, he strongly advocates the use by all naval powers of a floating dock, towed by a vessel containing ordinary ship-repairing tools, which could at any time be easily transferred to any base that the fleet may have seized, or could provide or supplement the docking accommodation in those home ports where the same did not exist or was of insufficient capacity. The drawback to the extensive use of such a dock would naturally be the depth of water required at its moorings, but it is pointed out that the maximum amount of excavation required for the berth of a floating dock would never be more than that required for the excavated dock, with the advantage that whereas in the latter case the excavation would have to be made entirely in the dry, in the former it would merely be the removal of material by ordinary dredgers. On the other hand, the floating dock possesses many advantages in the choice of site, since it can be placed end-on with the stream, thus facilitating the entrance of vessels; and it does not require its entrance to be placed, like that of most graving-docks, more or less at right-angles to the stream. Again, in rivers which are subject to a strong freshet, the floating dock is equally available either at high or low water, whereas a stone graving-dock would either have to be built very much deeper than required, or else would be submerged in times of flood. In connection with this, the author discusses the point whether a vessel on a floating dock is not much better placed for purposes of repairing or painting than in the bottom of an excavated dock, and points out how open to light and air are vessels on the former. He also claims that this openness of the floating dock has other advantages in that it allows them to deal with vessels of much greater length than the dock itself, and instances of this facility are adduced; while the one-sided docks have an equal advantage as regards beam of vessels lifted. It is admitted that floating docks have their limitations, represented by the amount of their lifting power; but at the same time it is argued that though they may not be able to lift a vessel entirely, they can frequently lift it enough to enable the required repairs to be effected.

Framing for Coal Hoppers, Power Station of London Underground Railway.

The first cost of floating docks is dealt with, and in order that an idea of their cost may be obtained, a list of the actual hull weights of several docks of different types are given.

The cost of working is also dealth with, and it is pointed out that the floating dock has a great advantage in respect of the cost of coal and oil, as the power required to lift a ship is much less than that required for a graving-dock of similar capacity. Instances are given where it costs, on the average, less than 18s. to lift vessels displacing 3,000 tons.

The cost of working is also dealt with, and it gone into in some detail, and in the appendix many instances of the actual amounts expended on repair and upkeep are given, based on the results of a number of years; from these it is found that the average cost is a little more than 1 per cent. per annum of the first cost of the dock.

Some further statistics are given as to the useful life of a floating dock, and iron docks which have now been at work for over 40 years are mentioned, from which the author concludes that the useful life of a floating dock may be fairly taken as at least 50 years. He points out that a life of this duration requires only a sinking-fund equal to 1 per cent. per annum on the first cost of the dock invested at 2½ per cent.

DIRECTNESS OF EXHAUST-STEAM CONNECTIONS, especially where high vacua are desired, is generally provided for in power-station design, but the relative effect of interposed valves is often greater than supposed. In a recent test at the Battersea electric central station, London, it was found that of a drop of vacuum from engine exhaust to condenser of 1½ in. of mercury, 0.8 in. was due to a non-return valve.

Test of a New System of Terra-Cotta Floors.

Builders, architects, engineers and insurance people in Pittsburg have been much interested in a test of a new floor construction made by the National Fireproofing Co. at its Bedford Ave. plant, in that city. The construction is to be employed throughout the floors of the big system of forty warehouses now under course of erection in Pittsburg for the Pittsburg Terminal Warehouse & Transfer Co. These warehouses are located along the Monongahela River, will have first-class wharf and switching facilities for the transfer of all kinds of merchandise both by rail and water, and will cost about $2,000,000 when completed. They will represent the highest type of fireproof construction, nothing but the latest and the most improved materials being used, and the insurance rates will be the lowest, it is stated, ever given on any building of this class in this country. Chairman C. G. Smith, of the National Board of Fire Underwriters, has declared that the warehouses will be models of fireproof construction for all builders in the United States to copy. Mr. Charles Bickel, of Pittsburg, is the architect, and Messrs. Kindel & Glaffey are the engineers of the work.

These buildings cover an area of 370x390 ft., with a basement below the first-floor level and six stories above. The four upper stories are divided longitudinally by a roadway 45 ft. wide. Exterior walls are to be of 13 in. of brick between pilasters. No stone will be used in the construction of exterior walls, and all sills will be of terra-cotta. Total height of buildings from railroad track to the top of parapet wall is 90 ft.

The first floor is arranged for a terminal station with six tracks entering the building; wide platforms are provided on each side of the tracks for receiving and distributing freight consigned to the different warehouses. Elevators are provided for each warehouse, enabling tenants to receive goods directly in their respective warehouses, with equal facilities provided for shipping goods to outside points.

In designing the building skeleton construction has been employed, and consists of the use of Z built-up columns connected horizontally at the floor levels with steel beams and girders, each floor being of sufficient strength to bear 350 lb. per square foot, with a factor of safety of 4.

The soil is of such nature that it was deemed advisable to use concrete piles, and upon this foundation concrete piers were erected forming the base of the steel columns.

The buildings throughout are fireproof. The floor and each bay will consist of four terra-cotta arches extending across the bay diagonally and at right angles to each other; 8-in. I-beams cambered to conform to the rise of the arches will be placed at right angles to the girders and beams, intersecting exactly in the center of the bays. By this method of construction it will be impossible for one entire bay or floor space to collapse in the event of some heavy object striking the arch.

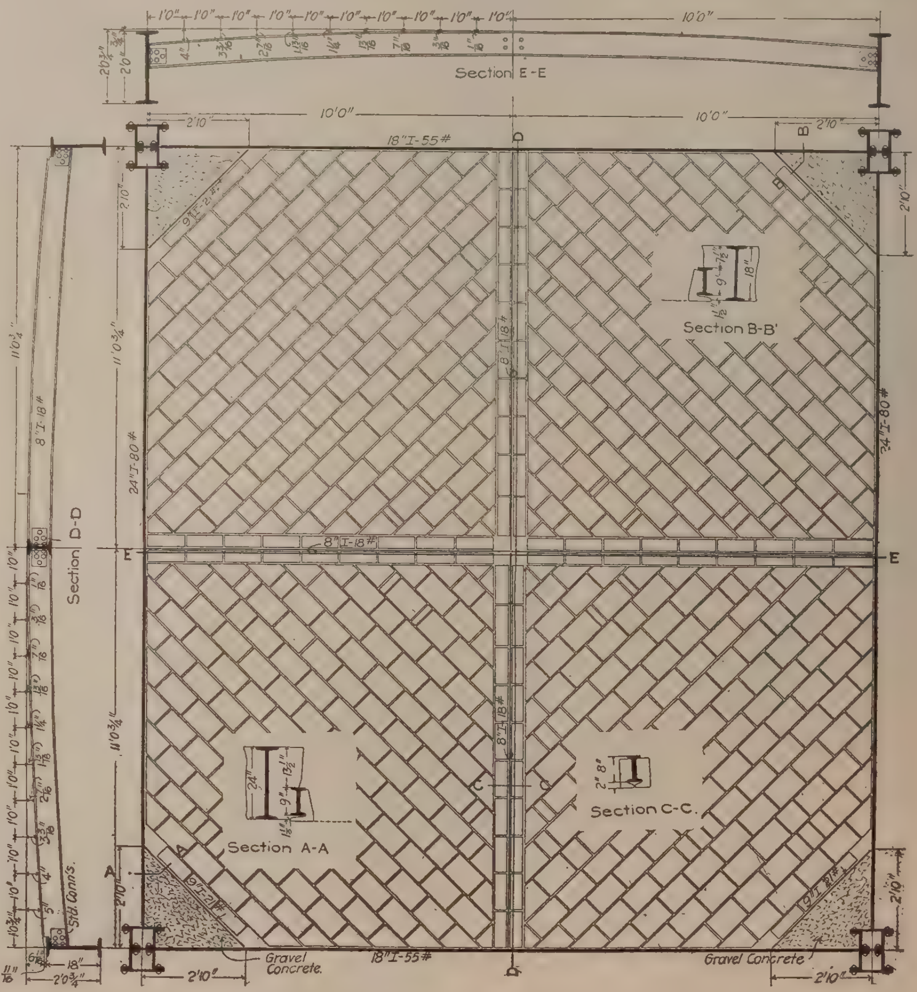
The floor arches are to be leveled with concrete, and topped with a cement finish 2 in. thick.

The arch proper will be made of hollow porous terra-cotta material in blocks 6 in. deep, 8 in. wide, and not over 12 in. long, set with broken joints, the shells averaging ⅞ in. thick. The arches will spring from the bottom flanges of the corner beams, thus diverting the loads direct to the columns, and have a rise in the center of 18 in. above the flanges.

The roof is what is known as the Johnson system of construction. A wire mesh is laid over the centering, this mesh to be imbedded in cement mortar not less than ¾ in. thick in proportion of one part of cement and 2½ parts of sand, and the tile laid in it and grouted in position. All beams will be covered with terra-cotta, the covering of the bottom of flanges of beams to be not less than 2 in. thick. The top will be leveled off with cement mortar and made smooth ready for roof covering, which will be four-ply roof gravel.

All floors will be made solid without openings, except the stairways and elevators, and will be inclined toward the division wall, away from the side in which the floor openings occur, at an inclination of 1 in. in 20 ft. Gutters will be formed of cement, with 4-in. pipe, passing through the walls on each floor level, with a light swinging cap attached to the pipe.

The Pittsburg Terminal Warehouse & Transfer Co. is much pleased with the results of the test, which will give it the lowest possible rate of insurance for its building and its tenants, as everything else about the warehouse system is being made equally as fireproof as the floors. The buildings are fast going up on the south side and will be ready for occupancy in a few months.



Floor System Used in New Pittsburg Warehouses.

The test was conducted on Dec. 7, 1904, by Prof. Ira H. Woolson, of the Columbia University, New York, Mr. W. L. Lemmon, consulting engineer for the National Board of Underwriters of New York City, and Mr. W. D. McGill, chairman of the local Underwriters' Board, and the Fire Marshal of Pittsburg.

Prof. Ira H. Woolson's official report on the recent test is substantially as follows:

The test building was of steel frame construction, 20x22 ft., with corner posts and I-beam girders between. The longer girders were 24 in. deep, and the shorter ones 18 in. deep. This frame was encased by a 13-in. brick wall on two sides and by a 9-in. combination tile and cement wall on the other two sides, the object being to study the relative merits of the two types of walls as fire barriers.

The floor to be tested constituted the roof of the test building. It was constructed by forming a groined arch of 6-in. hollow tile between the girders, with a rise of 17 in. at the crown. Above the tile was a concrete filling of about 4 in. over the crown and 18 in. at the haunches. The arches were sprung from the corners of the rectangular floor space instead of the sides, thus throwing the greatest thrust to the corners where the framework could best resist the load.

For purpose of reinforcement, two 8-in. I beams were put in between each pair of girders at the middle and meeting in the center of the floor span. These beams were cambered to the curvature of the arch and divided the test floor into four equal parts. They were encased by the floor tile.

The construction was practically a reproduction of one unit of the floor system to be used by the new Pittsburg Terminal Warehouse & Transfer Co., where there will be 800,000 sq. ft. of floor space, all divided into spans 20x22 ft. the same as this.

In the warehouse building the thrust on one side of a girder would be resisted by the stiffness of the girder itself, supported by the thrust on the opposite side, due to the adjoining floor span. To approximate these conditions in the test building large I-beams were placed vertically against the outside of the walls, two on each side, spaced to give reinforcement to the girders at points about one-third of the span from each corner post. These

I-beams were securely anchored at the bottom and were fastened together in pairs across the building just over the roof, by large tie-rods with turnbuckles to bring them snugly to place. Similar tie-rods were put in diagonally between the corner posts, the effect being to hold the main girders securely in place and prevent possible deformation.

The floor proper of the test building was formed of an open checker-work of brick, the same as a kiln floor, and upon this the fire was built. The ceiling was 15 ft. 4 in. above the floor. Suitable draft openings, smoke flues, and firing door were provided.

The concrete "fill" was mixed in the proportions of 1 part of Vulcanite Portland cement, 3 parts of river sand and 6 parts of gravel. The tile ceiling was given a protective coating of 1 in. of cement.

The purpose of the test was to determine the effect of a continuous fire below the floor for four hours at an average temperature of 1,700° Fahr., the floor carrying at the same time a distributed load of 270 lb. per square foot; at the end of the four hours the under side of the floor (or ceiling) while still red hot to be subjected to a 1⅛-in. stream of cold water at short range under 60 lb. pressure for ten minutes. Deflection of floor to be measured continuously during the test.

Interior of Test Building after Fire.

Roof after Load of 1,000 Lb. per Foot.

The temperatures of the fire were obtained by two electric pyrometer couples suspended through the floor from above and hanging about 6 in. below the ceiling. One couple was near the crown of the arch, and the other in a corner, about 3 ft. from each wall. Readings were made upon each couple every three minutes. The fuel used was dry refuse wood, the frequency of firing being determined by the temperature of the test chamber.

The deflection which occurred at various stages of the test were measured by a Y-level reading upon a rod located upon the middle of the floor slab. The maximum deflection recorded by observations every 15 minutes was 0.04 ft., at the close of the test.

The water was applied by city firemen with a steamer detailed for the purpose. Owing to the location of the hydrant, it was necessary to use 500 ft. of 3-in. hose, but the engineer reported that he maintained a pressure on his gauge varying from 100 to 120 lb. per sq. inch during application of the water, and this was augmented by a fall of 40 to 50 ft. between the engine and the test house; so although a long line of hose was used, it is safe to say that the nozzle pressure was well above 60 lb. The firemen estimated it at 75 to 80 lb.

In applying the water, the stream was thrown back and forth over the whole ceiling as much as possible and not allowed to strike continuously in one place. As it was not practicable to flood the roof, as is customary in tests of this character, the stream was played on the ceiling continuously for ten minutes at full pressure.

Owing to the very large size of the test chamber and an insufficient flue area for the volume of fire, together with the fact that the fuel supply in the early part of the test was not sutiable to feed a fire of such magnitude, it was impossible to get high temperature during the first half of the test.

The quality of the fuel was changed during the latter part of the test, and the building having become thoroughly heated, it became easy to maintain high temperatures.

Because the temperatures in the early part of the test were low, which resulted in lowering the average, it was decided to ignore the first fifteen minutes of the test, and make it up by extending the time fifteen minutes over the four hours. The average of 3-minute readings from 11:15 a.m. to 3:15 p.m. was 1,725° at one couple and 1,642° at the other.

The cement coating on the ceiling began to blow off about ten minutes after the fire started, and a considerable portion of it fell before the expiration of the test. The roof was covered with a load of hollow tile several feet deep, making it impossible to ascertain whether any cracks developed there or not. As the roof was in compression in all parts of the deflections recorded were very small, it is not likely that cracks did occur there.

After application of the water, it was found that the cement coating was gone and the tile exposed where the water struck the ceiling, but the tile appeared to be in perfect condition with no cracks or broken parts. At least, none were apparent under a hasty inspection by torch immediately after the test.

After Prof. Woolson's tests were completed, the company loaded the floor to 1,000 lb. per square foot, which produced a maximum deflection of 1½ in.

A Central Heating Plant in a residence district of Detroit uses, during the heavy morning demands, the exhaust steam from generating units which supply current over the corresponding peak-load periods of the electric railways.

New Track Systems for City Streets.

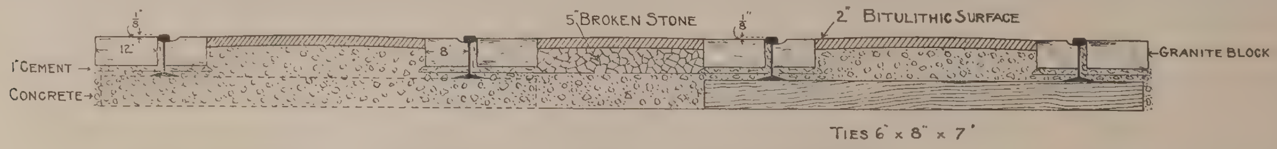
The most difficult problems which the city engineer has to solve in connection with pavements are due to the presence of tracks in the streets. It is to the interests of the railway companies to have a track as clear of vehicles as possible, and hence to make the portion of the street occupied by its lines unattractive to drivers. On the other hand, the city engineer must aim to secure a street which has the least amount of break due to the presence of the rails, and also to secure a system of track construction which is so durable that it will not jar the pavement about it. In discussing the subject it is important to look at it from both sides, and it is accordingly proposed to give in this place some views recently expressed by street railway officers.

The first suggestions that will be mentioned were those given by Mr. Thomas B. McMath at a recent convention of the Indiana Electric Railway Association. He stated that in Indianapolis his company had several miles of track of 9-in. girder rail laid on concrete beam, with ties spaced 12 ft. apart, and paved with brick laid on a concrete base. This construction is inadequate for interurban traffic. The College Ave. line of this city was constructed with 7-in. T-rails, on ties spaced 2 ft. between centers, ballasted with natural cement concrete, which concrete extends from 6 in. below the bottom of the tie to within 5 in. of the top of the rail, the street surface being vitrified brick, with nose brick forming the flange groove adjoining the rail. This construction has proved entirely satisfactory for interurban traffic.

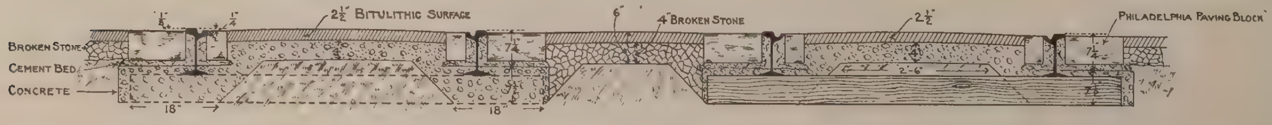
The tracks built last season and now used by the interurban cars on Ohio St. and Capitol Ave., were built with 7-in. T-rails, on ties spaced 12 ft. apart, and resting on a concrete beam 24 in. wide and 20 in. in depth under each rail. Tie-plates were used at intervals of 4 ft., and securely held by anchor bolts extending through the concrete.

It is Mr. McMath's belief, from experience in concrete beam work, that track constructed in the old manner failed from lifting, and that such anchorage, in addition to holding the track in line and gauge, would increase its stability by avoiding vertical movements. The use of the tie-plate between the ties permitted the suspension of the anchor bolts in their proper position during the process of concreting, the track having previously been brought to surface and line by tamping the ties. The concrete used was made of the best grade of Portland cement and had ample time to set.

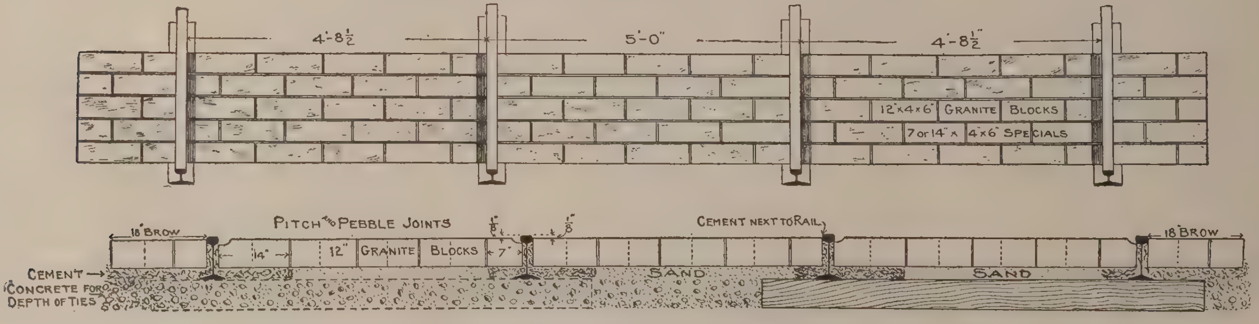
The flange groove alongside of the rail was obtained by the use of a special nose block, much larger than the ordinary paving brick, this block being 5 in. wide, 4½ in. thick, and 10 in. long, the balance of the pavement being the ordinary paving brick. The special shape of this block permitted its being laid longitudinally directly upon a mortar bed on the concrete, strips of wood being used to fill the cavity under the head of the rail, to prevent the special nose brick from coming in contact with the rail and to reduce the rumble of the passing cars. These wooden strips also act as a semi-elastic material adjoining the rail, taking up the thrust due to the expansion of the pavement between the rails.



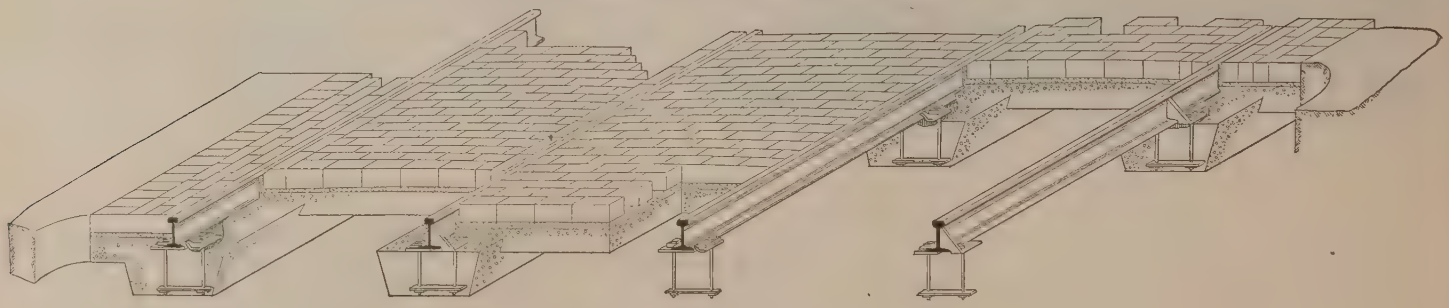
Cross-Section of Tracks in High Street, Medford.



Cross-Section of Tracks in Springfield Street, Cambridge.



Form of Construction in Boylston Street, Boston.



Track Construction on Concrete Used in Indianapolis.

Among the most interesting contributions to the information on this subject are some notes recently furnished to the "Street Railway Journal" by Mr. Arthur L. Plimpton, civil engineer of the Boston Elevated Ry. Co. In that city the high T-rail was never seriously considered until this last summer. The attention of some of the officers of the company was called to it in Minneapolis while visiting that city. They were so much pleased with its appearance and its perfect construction that the final result has been that several lengths of it have been laid on the Boston system, amounting in all to a little less than 13,000 ft. of single track. The Minneapolis form of construction was practically followed in most of the work, and does not differ materially from what has been done in several cities. Nevertheless, as in one case, bitulithic pavement was used, and as possibly there are some other differences in the details, the accompanying drawings, showing what was actually done in each case, may be of general interest.

As illustrative of this general type of construction in Boston, sections are given of the tracks in High St., Medford, and the form of construction used in Boylston St., Boston. In each of these cases, twelve ties were used in each 30 ft. of track; tie rods were placed 5 ft. apart and continuous rail-joints were used. It will be noted that in the case of High St., the concrete base is carried to within 2 in. of the surface and that this forms the base for the bitulithic surface, although usually this surface is laid upon a solid bed of broken stone. The reason for this change was that it was found that it would be impossible to properly roll the broken stone without injuring the tie rods, which came a little above what would have been the top surface of the broken stone.

The use of a rail with a T-rail head and the omission of a tram altogether, constitute, of course, a radical departure from girder-rail construction. It should not be supposed for a moment that, on any narrow streets where there is heavy team traffic, this form of construction would prove to be durable, as in such places, ruts of irregular depth would before long be formed alongside of the rails. The places selected for trial, therefore, were either where there is very little team travel on the street generally, or where the cars run so frequently, and where there are such good roadways that the teams keep off the tracks, as is the case on Boylston St.

Besides its use in connection with the T-rail track, bitulithic pavement has been used in several places in the girder-rail track, the form of construction being shown in the cross-section of the tracks of the Boston Elevated Ry. Co. in Springfield St., Cambridge. Here again tie rods prevented properly rolling a foundation of broken stone, so that concrete was used instead, except in the center between tracks.

How durable this form of pavement will be cannot be stated from actual experience on the Boston Elevated system, as this last season was the first time that it was ever tried. It is a very satisfactory pavement in one respect, as it presents a gritty surface, and horses can get a better foothold on it, when the street surfaces generally are in a slippery condition, than they can on most smooth pavements.

One of the greatest difficulties that presents itself at the present time in connection with the relaying of street railway tracks in the central parts of our cities where the streets are laid with a modern pavement on a concrete foundation, is to do the work properly without interrupting the car service.

To allow the concrete in the track to properly set and to become strong enough to stand the pounding of the heavy electric cars without injury, the cars should be taken off for a week or ten days. On a line of great traffic it is impossible to carry the traffic on a single track, and in narrow streets it would be impracticable to lay a temporary track outside of the permanent location, so the result is, all work on the tracks has to be done during the time at night when most of the traffic is suspended, which is for about five hours. The problem before the track engineer is therefore to put in durable construction and yet not to injure the fresh concrete by allowing the cars to operate over the track the next morning. Mr. Plimpton has given this matter considerable study, and has devised a method which has been tried in an experimental way, and which promises a solution of the difficulty.

The method is as follows: A short length of track, as much as it is practicable to complete in the ordinary way on ties 2½ ft. on centers, is relaid each night. The 6-in. layer of concrete is then put in between and around the ties and the cars are allowed to run over the track the next morning. The effect of this, of course, is to break the bond between the ties and the concrete, allowing a slight up and down movement of the track. There is placed under each rail and in each space between the regular ties a block of wood about 2 ft. long, 8 in. wide and 6 in. deep, with the sides beveled one way and the ends the other, so as to insure a bond. This block is bedded in the concrete and is left so as to give a space of 1 in. between the top surface of the block and the under side of the rail.

The movement of the track in no way disturbs these blocks, which at the end of ten days are held solidly in the concrete. Then at each block two wedges are inserted between it and the rail, one on each side of the rail, and are driven in so as to transfer the entire weight of that part of the track to the block. The method employed in the experiment was to then fasten the rail by means of clips and lag screws. By these means practically all movement of the rail under a passing car is eliminated.

It is advisable now to completely fill the spaces between the ties and the concrete, and the spaces under the ties created by the movement of the tracks, with quick-setting Portland cement grout. The pavement can then be put in without fear of movement of the rail disturbing the block next to it. The wooden block can be dispensed with and vertical bolts can be bedded in the concrete instead for holding the rail, or any other method that is desired, and which will accomplish the same result, can be used. The essential point is to create new points of support on the solid concrete to take the place of those permanently injured by the operation of the cars on the tracks before the concrete has hardened enough to stand the strain.

These suggestions are of special value because a railway company often thinks it must occupy a whole street when making such repairs.

General Engineering Features of the Denver, Northwestern & Pacific Ry.

The Denver, Northwestern & Pacific Ry. was projected as a trunk line between the cities of Denver, Colo., and Salt Lake, Utah. Organization was perfected by Mr. D. H. Moffat and associates in July, 1902; surveys were begun in April, 1902; and construction was started in January, 1903, at Utah Junction, 3.2 miles from Denver. The main line as constructed strikes a little north of west of Denver for a distance of 25 miles, crosses Coal Creek on a steel trestle with concrete foundations, skirts northerly along the foot-hills for about 5 miles; and runs thence nearly due west up South Boulder Cañon, toward the main range.

About 2 miles north of James Peak the Continental Divide will be pierced with a tunnel for the main line, and the driving of this tunnel will consume from two to two and one-half years.

To advance the work as rapidly as possible, pending the construction of the main range tunnel, it was decided to construct what is known as the Rollins Pass Branch, from Boulder Park, about 50 miles from Utah Junction, over Rollins Pass and down the western slope to a connection with the main line in Fraser River Valley. While the Rollins Pass Branch is deemed a necessity in order to transact business with the patrons of the road on the western slope of the range during the construction of the main range tunnel, its closeness to Denver and unsurpassed scenic attractions are features which will draw a heavy tourist travel and warrant a permanent operation each summer season.

The road is now constructed and in operation from Utah Junction, a distance of 73.17 miles, to Arrowhead, a new town well down on the western slope.

The maximum main-line grade is 2 per cent., compensated on curves at the rate of 0.035 per degree, and from Leyden Junction, at the foot of the front range, to the east portal of the main range tunnel, a distance of 45 miles, the grade is nearly continuous 2 per cent., except for the easing up to 1 per cent. or less at sidings.

The projected main range tunnel is at an elevation of 9,930 ft. above the sea level, and its length will be about 2.6 miles.

From the west portal of the main range tunnel there is a continuous descending grade of compensated 2 per cent. until the Fraser River Valley is reached, and from there westerly the grade varies from 1.25 per cent. to considerable less than 1 per cent.

The main-line maximum curvature is 10 deg. Forty-two per cent. of the entire distance from Utah Junction to Hot Sulphur Springs, 97.28 miles, is curved line, giving an average of 132 deg. per mile. Curves of 2 deg. and over are spiraled; compound curves of over 1 deg. difference in ratio are spiraled between curves; and a tangent of not less than 60 ft. is laid between the ends of the spirals where curves are in opposite directions. For 17 miles out of Utah Junction nothing sharper than 3 deg. is used, and curvature is restricted to a maximum of 4 deg. in the valley of the South Boulder River, near Rollinsville.

Track is elevated by Searles' rules, allowing for a speed of 30 miles per hour for passenger trains on 10 deg. curves. Vertical curves are laid when there is a difference of 0.4 per cent. in grade rates.

The widths of the roadway are 20 and 22 ft., in cuts of solid rock and earth respectively, and the fills are 18 and 16 ft.

Track-Laying Machine on the Denver, Northwestern & Pacific Railway.

One of the Tunnels on the Denver, Northwestern & Pacific Railway.

Rock excavation slopes vary from 1¼ to 1 to ¾ to 1; many of the strata in the front range are inclined, and often broken up and seamy. Slopes in loose rock excavation are ¾ to 1 and in earth excavation 1 to 1. Slopes for earth and rock fills are 1½ and 1¼ to 1, respectively.

The main line as constructed has numerous heavy cuts fills, the heaviest excavations being in rock, and many of them have an upper side cut of 100 to 125 ft., with yardage running from 30,000 to 40,000 cu. yd.

Quartz Creek, about 29 miles out, was first crossed on a temporary trestle 95 ft. high. This has now been filled with 130,000 cu. yd.

Between Utah Junction and Arrowhead the line as built includes about 50 miles of main line and 23 miles of branch line over Rollins Pass. The grading in earth amounted to only about 8 per cent., 35 per cent. being loose rock and 57 per cent. solid rock. Ditches in cuts are 4½ ft. wide on top, and have their bottom one foot below subgrade.

For a distance of 23 miles west of Utah Junction the track is ballasted with slag from Denver smelters. The balance of the line through to Arrowhead is ballasted with disintegrated granite and gravel. The ballast is 10 in. deep under ties, and extends 18 in. beyond their ends.

Ties are all Texas long leaf pine, 85 per cent. heart, 6x6-in. by 8 ft.

Rails are 80-lb. Am. Soc. C. E. section, laid on southern pine ties, 3,360 to each mile, with tie plates on each tie.

Under fills of 15 ft. and less on the prairie section, double strength vitrified pipe is used, and under higher fills box culverts of dry laid rock rubble are placed. The same kind of box culverts are used on the mountain section, and also some cast-iron pipe.

In the stretch of 13 miles of constructed line along the foot-hills fronting the plains, and up the South Boulder Canyon, the alternative propositions were constructing high viaducts and excavating heavy cuts, or laying the line on higher ground, and to as great an extent as possible eliminate trestle work and substitute tunnels. The high line was chosen as giving better alignment and a safer and more permanent roadbed. This necessitated the driving of 30 tunnels, ranging from 73 to 1,729 ft. in length, and aggregating 16,000 ft.

The normal section of tunnel excavation on tangent is 16 ft. in width and 24 ft. in height, or 22 ft. above top of rail. The width is increased on curves as requirements demanded, reaching 17.5 ft. for a 10-deg. curve.

Tunnel excavation was to a large extent in solid rock, but in numerous cases seams made it advisable to insert timber lining. In nearly all cases timbers were 12x12-in.

Very few small bridges were required considering the character of the country. The crossing of Coal Creek required a steel trestle consisting of three 64-ft. and two 32-ft. deck girder spans. There are 45 temporary timber trestles on the main line east of Rollins Pass Branch junction. These are to be filled in. The highest of these trestles is 81 ft., at the crossing of Bull Gulch, about 25 miles out of Utah Junction.

The Rollins Pass Branch was constructed in order to reach Middle Park and the country beyond without waiting for the construction of the main range tunnel. Its maximum grade is 4 per cent., compensated 0.035 per degree on curves, and the line is usually laid up to the maximum on both the east and west slopes. For about 3,000 ft. across the summit the grade is practically level. Curves for this line are laid with 16 deg. maximum, but few curves of this degree were resorted to, owing to the topography of the country. Curves of 2 deg. and over are spiraled.

The roadbed of the Rollins Pass Branch is 16 ft. wide in cuts and 14 ft. on fills, and something over a mile of the line has been snowshedded. The same track construction is used on the branch as on the main line. The altitude of Rollins Pass is 11,660 ft., and the scenic features crossing the range are not excelled.

After crossing the main range west of Denver the line will travel the Grand River valley through Middle Park, 48 miles; the Yampa (or Bear) River, 153 miles; the Green and its tributary, the Duchesne River, and its tributaries, 160 miles; and thence pass over the Wasatch Range into Salt Lake Valley.

While the Denver, Northwestern & Pacific Ry. may properly be considered a mountain line, its adaptability of route through the valleys of Northwestern Colorado and Northeastern Utah, which all run in the direction desired, permit the obtaining of a most direct route with light grades and curves, and will enable the road to accommodate an immense tonnage at minimum cost.

The contractors for the construction so far as completed are Orman & Crook, of Denver; Geo. S. Good & Co., of Pennsylvania; and Streeter & Lusk, of Colorado. Contracts have been let and active construction is in progress by Orman & Crook, of Denver, and Dunphy & Nelson, of Fraser, Colo., from the present terminus of the Rollins Pass Branch at Arrowhead to Hot Sulphur Springs, the county seat of Grand County.

The chief engineer of the railway company is Mr. H. A. Sumner, whose experience in location and construction of difficult railway work in the mountainous regions of the West covers many years. During the entire progress of the work, and at the present time, his chief assistants are Mr. L. D. Blauvelt, resident engineer in charge of work east of the summit of the Continental Divide; Mr. E. A. Meredith, resident engineer for the work on the slope west of the summit, and Mr. H. L. Aulls, office engineer.

Piping Detail in an English Station.

The live steam piping from the main header to each engine in the power station at Smethwick, England, for the Birmingham & Midland tramways, is brought horizontally through the partition wall between boiler and engine rooms, and, with a 90-deg. bend, drops vertically into a vertical receiver of comparatively large size at the engine cylinder. In line with the vertical portion of the pipe, to support the receiver, is a pipe stanchion with cast-iron base resting on the floor. From the top of the receiver the steam is led into the cylinder, with a valve next to the receiver, and the connection to the cylinder is a 180-deg. bend in a vertical plane. There is a valve in each steam line on its entrance into the engine room, and this and the valve at the receiver are high enough so that the extended stems were necessary, dropping to a point within easy reach from the floor. There are three 500-kw. and three 300-kw. units in the station, the larger being alternating-current sets and the smaller direct-current sets. The larger engines are triple expansion, while the smaller engines are three-cylinder compounds; they are all of the vertical type, built by the Brush Electrical Engineering Co., at Loughborough.

Tunnel Views on the Denver, Northwestern & Pacific Railway.

The Subway of the Philadelphia Rapid Transit Co.

The subway of the Philadelphia Rapid Transit Co., under Market St., Philadelphia, is approaching completion from the Schuylkill River to 15th St., a length of about 4,000 ft. The line will probably be operated at first for about 5 miles from the city hall to the terminal, about ½ mile west of 63d and Market Sts. This portion of the line has been divided into four sections during construction. Section 1 is a four-track bridge over the Schuylkill River; Section 2 is a two-track elevated structure from the bridge to 63d and Market Sts.; Section 3 is the portion of the subway between 15th St. and 22d St.; Section 4 includes the remainder of the subway west of 22d St. and the east approach to the bridge. The original plans, described in The Engineering Record of April 18, 1903, have been changed with respect to the 19th St. station and the approaches to it, the style of roof, and in other more minor particulars. It is a four-track concrete-lined tunnel, built in open trench, with the tracks all at one level. Its center line coincides with the center line of Market St. from 15th St. to 47 ft. west of 22d St., where it deflects to the north on reverse transition curves to the Schuylkill River bridge, the center line of which is 100 ft. north of the center line of the municipal bridge carrying Market St.

The two outside tracks will be for trolley cars, and will connect with a loop in the business district, so that eastbound cars will be operated over the south outside track and return westbound on the north outside track. The two inner tracks will receive the trains from the elevated tracks west on Market St. and will connect with a subway on the east side of the city.

Standard Section.—The standard tunnel cross section on tangent is shown in an accompanying cut. It has a clear width of 48½ ft. and a clear height of 14 ft. 5½ in. above the base of rail. The concrete roof is carried by 20-in. 65-lb. transverse I-beams, on 5-ft. centers. The beams are tied together by ¾-in. rods, from 5 to 5½ ft. apart. A strip of Clinton wire cloth 18 in. wide, with 4x6-in. mesh, is placed over and parallel to each beam, with the principal or heavier wires transverse to the beam, to reduce the liability of cracking of the concrete over the top flanges of the beams. The top of the roof is sloped 2 in. in 12 ft. both ways from the center line.

The beams of the roof are supported on the side walls and three longitudinal rows of steel columns between the tracks, spaced the same as the beams which rest upon them. The columns are built of four 4x3x⅜-in. angles and a 6x¼-in. plate. The beams of the roof rest on 9x14x½-in. top plates connected to the columns by 6x3½x⅜-in. bracket angles. The columns rest on a 14½x16x¾-in. base plate to which they are attached by 6x3½x½-in. connecting angles.

Derricks on North Side of Market St.; Pavement Relaid over Completed Section on the South.

The roof beams extend 16 in. into the side walls and rest on 12x12½x¾-in. bearing plates riveted to their lower flanges. There are no wall beams between their ends, but they are held in place by the concrete of the side walls, cheek angles being united to the backs of the beams.

The side walls, 3 ft. 5½ in. thick, have vertical sides and are reinforced by vertical and horizontal rods near their inner faces. They are thicker than is theoretically required, owing to the contractor's desire to increase the section to facilitate construction by the methods adopted. For the early stages of the work the vertical reinforcement was made up of 1⅛-in. Thacher rods, placed 18-in. apart, and the horizontal reinforcement of ⅝-in. Thacher rods, placed 15 in. apart, with the joints of the horizontal rods lapped 18 in. Later 1-in. vertical rods were substituted in parts of the work, and these were placed 15 in. apart in the north wall and 12 in. apart in the south wall, which contains a row of terra cotta ducts for electric cables.

Concrete Mixers at Openings on South Side of Market St.

The concrete floor is without reinforcement, and its underside is flat. The upper side is in the shape of flat inverted arches between the 1½-ft. footing offset at the inside of the outside walls and the footings of the columns. The floor has a minimum thickness on rock foundations of 1 ft. 6 in. at the lowest point of the inverted arches, and this thickness is increased 5 in. over earth foundations.

Concrete.—The specifications required that a mixture of 1 part Portland cement, 2½ parts gravel or coarse sand and 5 parts crushed granite or trap rock, by measure, be employed in the concrete under ordinary conditions. In the excavation for the sidewalls a gravel was found which, after screening, fulfilled the requirements of the specifications for "coarse sand or gravel, graded from coarse to fine, to reject all particles exceeding ¼-in. in diameter, and free from loam, dirt or dust" for use with crushed stone in the concrete, with the exception of its freedom from loam. Extensive tests were made to determine the effect of the presence of this loam, which averaged about 25 per cent. of the volume of the gravel and contained clay, finely decomposed rock and about 50 per cent. of finely comminuted silica. These tests proved that the presence of the loam would not prevent the safe use of the best excavation gravel. So in various parts of the work the 2½ parts of gravel, as originally specified, have been replaced by trap rock grit and screened gravel from the excavation in equal proportions. In the general mass of the work, and in ordinary situations, the proportions have also been changed to 1 part Portland cement, 3 parts in equal proportions of excavation gravel and trap rock grit, and 6 parts of crusher-run broken trap rock, screened to remove all dust and dirt, and the largest pieces not exceeding 1 in. in any direction.

The concrete in portions of the floor has been made of cement and gravel in the proportions of 1:9, the gravel being screened to grade from fine sand to pebbles not exceeding the size of the broken stone ordinarily used as ballast. The mixing has been done, with slight exception, in 1-yd. McKelvey machine mixers. The mixture is made so wet that the men sink to their ankles when working in it in the forms.

Three brands of cement, Giant, Star Bonneville, and Vulcanite, have been used in the concrete. The cement is subjected to thorough tests for fineness, soundness and tensile strength according to the specifications of the company, the tests being made to conform with the methods recommended by the committee on uniform tests of cement of the American Society of Civil Engineers.

Waterproofing.—The roof over its entire length is waterproofed with asphalt mastic, laid in two ½-in. layers, with all joints well lapped. The side walls are waterproofed with Cerion waterproofing on layers of burlap. The waterproofing in the south wall is placed just outside the rows of vitrified clay ducts for electric cables which are built in it. The exterior side of the row of ducts is coated with cement mortar after they are in place in the wall. A coat of Cerion waterproofing is applied over the mortar, followed by a layer of burlap, then a second coat of waterproofing, then a second layer of burlap covered with a final coat of waterproofing. The waterproofing of the roof is covered by 3 in. of concrete and that on the side walls by 8 in. of concrete, to avoid mechanical injury to it and to keep it as plastic as possible. The south wall, into which terra-cotta ducts are built is waterproofed throughout its length, but only the west end of the north wall, in which there are no ducts, is so protected, as the thickness of the wall where the concrete replaces the space occupied by the ducts in the other wall, is depended upon to prevent percolation. The floor is not waterproofed in any part of the tunnel, but a drainage system has been introduced to lower the ground water level.

Drainage System.—The grade of the tunnel descends from both ends toward a sump and pump pit at 22d St. A line of 12-in. terra cotta pipe is laid longitudinally in concrete beneath the floor of each outside track and leads to this sump. Sumps are placed every 50 ft. on these lines of pipe. Laterals of 4-in. terra cotta pipes, also imbedded in concrete, extend under the side walls, with their ends open and turned down just outside the wall, and are connected with these sumps. The floors of the center tracks are sloped to drain to sumps placed 500 ft. apart in them and on line with the sumps in the side tracks, to the adjacent one of which they are connected by lateral pipes laid in concrete under the floor.

The longitudinal lines of drain pipes have their outlets in a transverse sump, 3 ft. wide and 4 ft. deep, built beneath the floor of the tunnel at 22d St., and connected to a pump well, 8½ ft. deep and 9½x11 ft. in plan, built in connection with the north wall. Two submerged horizontal centrifugal pumps, one a 3-in. and the other a 4-in., are placed in the pump well at the side and are each direct connected by a vertical shaft to an electric motor in a small pump room built over the well. The operation of the motors is automatically controlled by floats on the surface of the water in the chamber below. The combined capacity of the two pumps is about 300 gal. per minute, which is more than sufficient to elevate from the sump to their discharge into the sewer in the street any flow of water that has reached them.

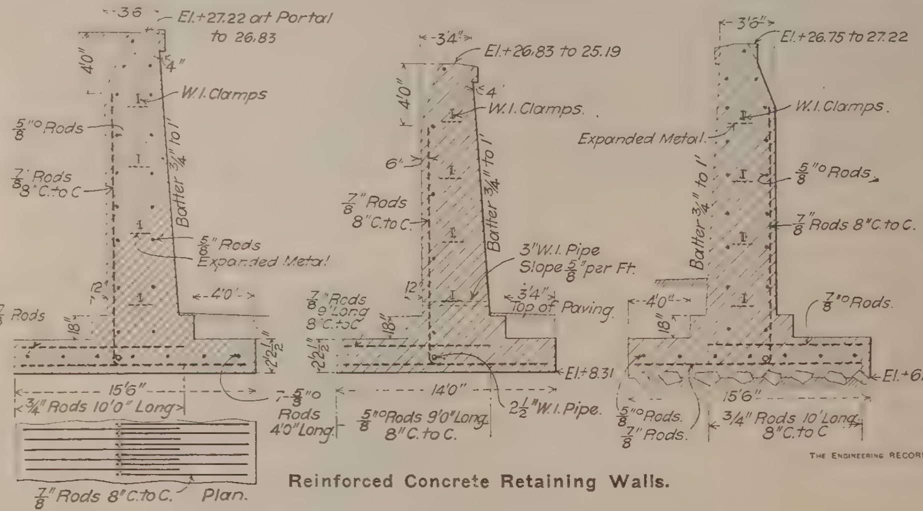
Ventilation.—Ventilation chambers are built in the side walls at intervals. They are connected to the outside and are so arranged that fans may be installed in them if necessary. The tunnel at 22d St. passes quite close to two large gas holders for municipal supply, and, as the ground in the vicinity has in the past been more or less impregnated with leakage from them, a ventilation chamber, with an opening 7 ft. high and 18½ ft. wide, has been built adjoining the pump room in the north wall and is connected by a horizontal duct, 8 ft. square, to a masonry stack, 60 ft. high.

Relocation of Underground Structures.—Combined sewers in which the flow was from the south to the north, crossed the line of the tunnel in Market St. and were joined to an outfall sewer in an adjoining east and west street. The sewers in Market St. served chiefly the property facing on it. The first work of construction included the building of a large intercepting sewer parallel to the subway to take the flow of the cross street sewers. This has a circular reinforced concrete section, with a diameter of 3½ ft. at upper end which is increased at different points to 4 ft. 9 in. at its outlet. It is built as a part of the south wall as far as the deflection of the tunnel at 23d St., from which point it is continued as a separate structure to an outlet in the Schuylkill River.

Smaller sewers of reinforced concrete or of terra cotta pipe laid in concrete are built separate from the tunnel wall along the north side of the street and connect with a trunk sewer on an adjoining street. The section of the concrete and the amount of reinforcement in the sewers is somewhat heavier than is used under ordinary circumstances. The uncertain conditions to which the sewer barrels are subjected during construction required this increase and the advisability of its adoption has been demonstrated by an accident which occurred while work was in progress near 21st St. The excavation of the subway trench was being made at this point when a connection between two large city water mains broke and before the flow could be shut off a washout had occurred which left a 2x3-ft. egg-shaped sewer on the north side of the subway entirely unsupported for a span of 45 ft. The sewer barrel sustained itself and the debris above it, however, without apparent damage until blocking could be placed under it.

The large gas mains leading from the storage holders at 22d St. and the city water mains have also been relocated. In the construction of the tunnel at least 4 ft. of cover over the roof of the tunnel has been maintained. This has been increased in places to 6 ft. and the gas and water mains have largely been carried across the subway in this covering.

Several conduits containing the cables of the Bell Telephone Co. and of the Keystone Telephone Co. had been laid in Market St., and provisions were made for their readjustment. The conduits of the former company were relocated in an adjoining parallel street. A portion of the cable system of the latter company was placed in ducts in the south wall and the remainder relaid over the tunnel on the north side of the street in practically their original location. The cables carrying the electric power used in operating the subway and portions of the lines connected with it are also carried in ducts placed in the south wall beneath and separated from those of the telephone company. Rectangular duct chambers 11½ ft. long, with arched rear walls are built in pairs in the walls at intervals to facilitate pulling cables through the ducts. One of the chambers is just deep enough to provide access to the telephone ducts and can be entered only through a manhole in the street. The other chamber extends the full depth of the subway and may be entered either from a manhole in the street or from the interior of the subway.



Reinforced Concrete Retaining Walls.

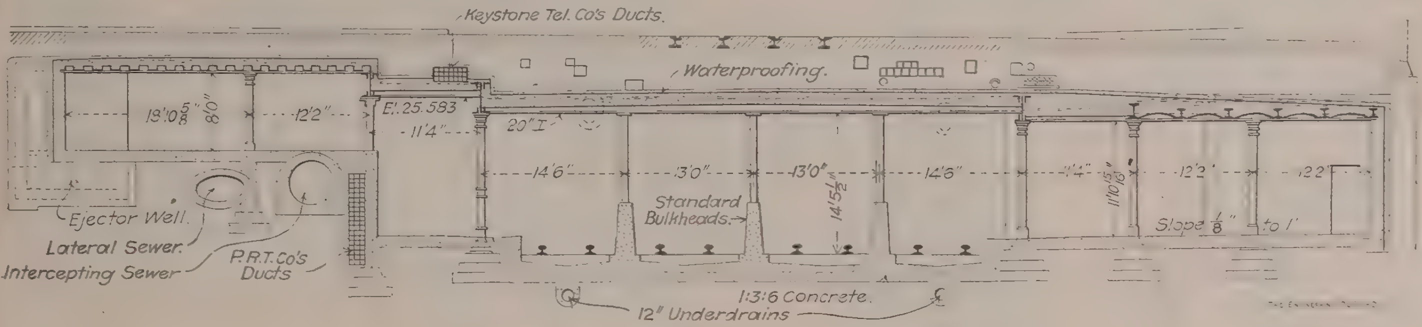
Raising Grades.—To secure practicable working grades for the ascent to the Schuylkill River Bridge, and at the same time have sufficient clearance over the Baltimore & Ohio R. R., along the east bank of the river, a large amount of filling was necessary over the area in the vicinity of Twenty-third and Market Sts. The original grade at the intersection of these streets was approximately 9 ft. below the subway roof and the surrounding area was at about the same elevation. The approach to the Market St. bridge rose on a grade of about 5 per cent. from this point, which has been materially reduced and improved. The city undertook the change of street grades in the area affected. In the change on Market St. a portion of the underground structures were first relaid or relocated and then a dry-rubble masonry wall, with a maximum height of 12 ft. was built south of the south street railway track so that traffic was maintained on both the east and west bound tracks, and also on the north shoulder. The permanent concrete retaining walls along the south street line were also built at the same time, and as the walls were finished the south shoulder of the street was brought to the new grade with material excavated from the subway site. The traffic on the two tracks in the middle of the street was diverted to temporary tracks laid on the new grade and the old tracks removed to permit the completion of the fill and the construction of the subway.

Subway Construction.—From the point where the subway deflects to the north at 23d St. to the river bridge, the tunnel is across ground included in Market St., as it is widened to the north, so construction was commenced at the portal of the tunnel just west of 23d St. The side walls were built simultaneously from the portal to within the old lines of Market St. near 23d St.; the supporting columns and the beams of the roof were then erected and the concrete of the roof put in place. There is no earth covering over this portion of the tunnel, and the top of the roof is continued as a part of the sidewalk on the north side of Market St., and forms a broad pláza with a high ornamental iron fence along its inner edge.

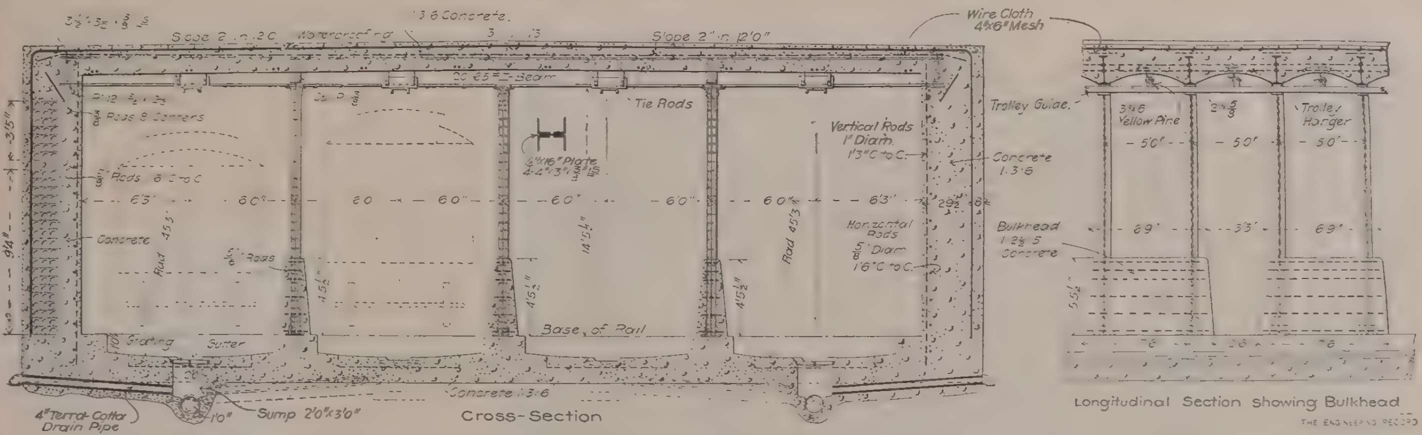
The side walls of this length of the tunnel and the concrete retaining walls on either side of the tracks west of the portal are reinforced differently from the walls on the remainder of the work. The fill in the street on the south of the tunnel is subjected to a heavy traffic and makes the thrust against the south wall much greater than that brought against the north wall as there is no traffic on the new fill on that side. The tendency is for this inequality to be transmitted through the roof to the north wall with a resultant tendency of the upper part of the whole structure to be thrown out of line and to become deformed. To overcome this unequal side pressure the south wall has 1⅛-in. vertical rods, on 8-in. centers, 11 in. from its outer face and 3 in. inside the waterproofing, in addition to the regular reinforcement near the inner face. These outer rods extend from a point about a foot below the top of an offset in the wall at the grade of the adjoining street to within 5 in. of the bottom, where they are bent at right angles on a radius of 1 ft. and reach, horizontally, 4 ft. along the bottom toward the center of the subway. Alternating with the horizontal portion of the vertical rods are 1⅛-in. horizontal rods, transverse to the subway, and 10 ft. long, on 8 in. centers, with their outer ends in line with the plane of the vertical rods. The wall also has a total thickness of 4 ft. 8½ in., as compared with the usual thickness of 3 ft. 5½ in. The spacing of the ⅝-in. horizontal rods near the inner face is increased from 1 ft. 6 in. to 1 ft. 10½ in. on centers.

The vertical rods near the front face of the north wall are also bent at the bottom and continued horizontally, but away from the front of the wall instead of toward it as in the case of the vertical rods in the back face of the south wall. The vertical reinforcement placed near the back face of that wall and the horizontal rods near the bottom of its footing course are omitted in the north wall and the thickness is not increased over that of the walls in the standard section.

Reinforced Concrete Retaining Wall.—The retaining walls west of the portal are built in 30-ft. sections, with broad footing courses and specially designed reinforcement for each section. The sections joining the portal have ⅝-in. longitudinal horizontal rods on 2-ft. centers near their central vertical plane and near the middle of their footing courses to bind them to the walls of the subway and are the only part of the retaining walls containing reinforcement in those positions. The bulk of the reinforcement in them is in the same position as in the remainder of the walls, and is made of ⅞-in. horizontal and vertical rods 6 in. inside of their back faces. The horizontal rods are on 2-ft. centers. The vertical rods are 8 in. apart and extend from 4 ft. below the top of the wall to within 6 in. of the bottom of the footing course, where they bend at right angles toward the front face and continue horizontally to within 6 in. of the toe of the footing or platform course. A piece of 2½-in. gas pipe, 7 in. long and filled with concrete, is placed in each bend transverse to the rod and the rod wired to it to relieve the crushing tendency in the concrete at the point of the bend by an upward pull. Horizontal ¾-in. rods 10 ft. long, are placed in the same plane with the horizontal portion of the vertical rods, with one end 6 in. from the heel of the footing course or platform and alternate with those rods on 8-in. centers. Six inches below the top of the lower footing course, which is 2½ ft. deep and of a width of about nine-tenths the height of the wall in all sections, are placed transverse, horizontal, ⅞-in. rods, also 10 ft. long with their ends at the heel of the footing in line with the ends of the ¾-in. rods below them. The reinforcement in the remainder of the walls has the same general arrangement as it has in these two sections and as the height decreases the rods are decreased in size, but the spacing remains the same.



Cross-Section through the Nineteenth St. Station.



Cross-Section

Longitudinal Section Showing Bulkhead

Standard Sections on Tangents of the Subway Tunnel of the Philadelphia Rapid Transit Co.

Clamps are placed at the joints between the sections which prevent unequal lateral motion of adjoining sections, but permit difference in settlement in them. The number of clamps depends on the height of the wall. They are made of three 5x12x¾-in. steel plates in a tongue and grove arrangement. One plate is imbedded 9 in. in one section and the other two are imbedded their full length on either side of it in the adjoining section, thus forming a joint in which vertical, but not lateral motion can take place. The clamps are placed about 3 ft. apart on the vertical center line of the wall.

Construction under Market St.—Market St. is one of the principal business streets of Philadelphia and as such carries a heavy traffic which had to be maintained during construction. The plans for construction were made with minimum interference with this traffic as a governing factor. The work has been carried on in such manner that never more than one-third of the width of the street has been closed and the operation of street cars over the two tracks in the center of the street has never been interrupted.

The tunnel under the street is being built in three longitudinal sections. A trench was opened first at the east end of the section east of 23d St. and the construction of the south wall and the large intercepting sewer, which from the river to this point are separate structures, was commenced. After about 1,000 ft. of the wall and the sewer had been built the methods were changed to include the floor and roof of the tunnel to the first row of columns and the columns in the longitudinal section.

The trench was opened simultaneously at several points and when the top excavation had been removed stiff-leg derricks were set up at the openings. The excavated material was then shoveled into buckets, which were elevated by the derricks and dumped in one or two-horse carts that hauled the material to the various places were it was utilized in filling. Four McKelvey concrete mixers were set at the different openings adjacent to the derricks, when the trench had progressed far enough to begin the wall construction. These mixers were placed so that carts could approach and discharge the materials for the concrete on a platform at the level of the charging hoppers. The concrete was discharged through a chute into buckets which were lowered into place by the derricks.

As this longitudinal section and the sewer were completed, the earth covering of the roof was backfilled and the pavement relaid. The sheeting of the trench along the unfinished side of the work was left in place. When the longitudinal section on the south had been nearly completed the trench for the north wall was opened and the construction of a longitudinal section of the tunnel on that side commenced and carried on in a manner similar to that employed on the section at the south. This section included only the side wall and floor to the inside of the footings of the first row of columns and that row of columns, the roof being left out to facilitate the removal of the excavation from the middle section.

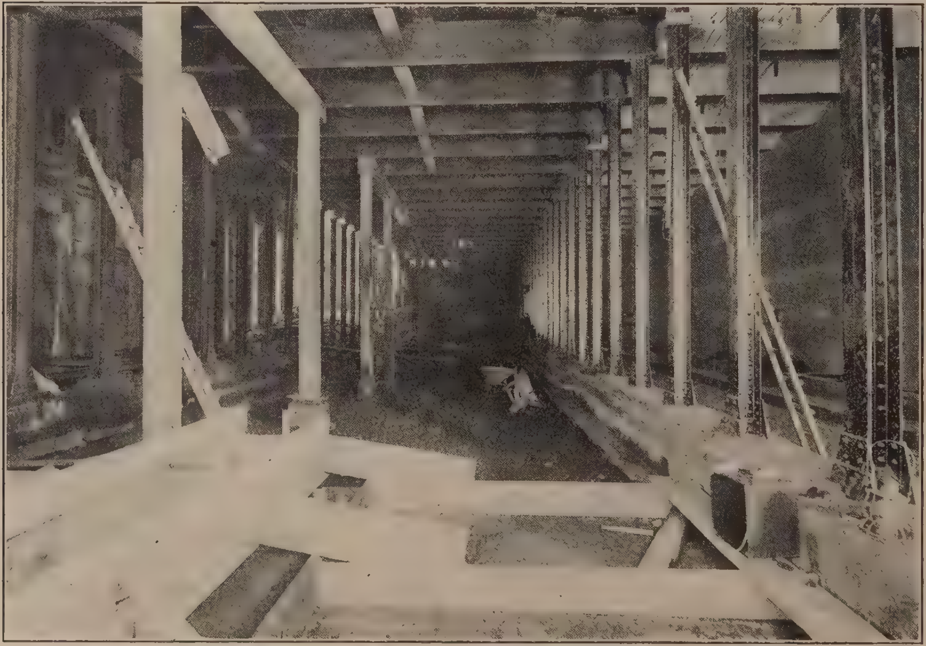
When a part of the longitudinal section on each side had been completed the removal of the core at the center and the construction of the floor and roof of the tunnel for the two center tracks was commenced. The pavement was torn up between and on both sides of the street car tracks on the surface and four 12x14-in. timber stringers were placed under the tracks and a flooring of 2-in. and 3-in. planks was laid, and cross ties placed over the stringers and the pavement relaid. The core of the excavation was then removed by drifting in from the north side and blocking up the stringers under the tracks until sufficient material had been removed to temporarily insert the beams of the roof in their permanent positions on top of the columns. The roof beams are made in three sections, the sections at either side the width of one track span and the center section the width of the two center track spans. When the excavation is finished the center line of columns is erected, the roof beams field riveted to them and spliced together and the concrete of the roof placed. The roof over the north longitudinal section is built last.

There are three stations on the subway, at 15th St., 19th St., and at the east end of the Schuylkill River bridge. The latter is intended for trolley cars only and is designed to make connection with the Baltimore & Ohio R. R., which parallels the bank of the river. The station at 19th St. is also intended only for local service.

The columns in the outside rows are omitted for 150 ft. on either side of the 19th St. station to permit the construction of crossovers between the adjoining tracks on either side. The span of the roof beams is thus increased to 25 ft. and 30-in. built-up beams are substituted in place of the usual 20-in. 65-lb. I-beams. During the construction, these beams support the overhead tracks and are blocked up on 12x12-in. posts until the excavation is completed; then the center line of columns is erected, the beams placed on them and the roof built as in the remainder of the work.

Ground was broken for the subway work on April 6, 1903, and the tunnel is practically completed east from the portal to the west side of 21st St. East from this point the portion of the structure, comprising the south track, is built nearly to 16th St., with the exception of a portion of the roof at the crossover tracks east and west of the 19th St. station. The excavation, floor and side wall of the north section are completed between 21st and 17th Sts., and about 70 per cent. of the excavation for the middle section in this length has been made and work on the concrete floor and the erection of the roof beams and columns is now being carried on.

View at Tunnel Portal Showing Height of Fill in the Adjoining Streets.


View during Construction Showing Method of Building Longitudinal Sections.

The plans for the subway, the river bridge and the elevated structure connected with them were made in the office of the Philadelphia Rapid Transit Co. Mr. W. S. Twining is chief engineer of that company, Mr. Chas. M. Mills, principal assistant engineer of the subway and elevated railroad construction, and Mr. Frank L. Fisher, resident engineer in charge of the subway construction. The E. E. Smith Contracting Co., of Philadelphia, has the general contract for Sections 3 and 4 and the subcontract for the work done by the city in raising the grade of Market St. and the streets adjacent to 23d St.

The Tokio Tramway Power Plant, Japan, is equipped with machinery of American manufacture. It may also be of interest that primary feed-water heaters of the Wainwright type are used with each main McIntosh & Seymour engine, and in addition one secondary heater for the plant auxiliaries.

Power Regulation of an Electric Hoist.

The electric hoisting plant at a colliery at Ligny-les-Aire, France, described recently in the "Iron and Coal Trades Review," of London, is of particular interest in respect to the electrical equipment installed to nullify the fluctuations of the hoisting motor demands at the primary power station. The hoist is designed to lift 105 tons of coal per hour from a depth of 1,412 ft. at an average speed of 24 ft. per second. Each of the two cages has four decks and the total load per cage is 4,800 lb. The main pulley, 13 ft. in diameter, is direct driven by a direct-current motor on each end of the shaft, with an aggregate maximum power of 500 h.p. At starting the maximum effort is about 600 h.p., decreasing to 300 h.p. during the trip. The so-called buffer set consists of a starting dynamo, a buffer motor and a supplementary motor all mounted on a common shaft carrying a large flywheel. When the hoisting motors are at rest, the starting dynamo, in series with the circuit, develops the same voltage as the primary station, but in the opposite direction, so that the voltage at the terminals of the winding motors is reduced to zero. At the moment of starting the cages, the excitation of the starting dynamo is lessened, so that the tension at the terminals of the winding motors is increased and the latter begin to run. When the velocity of the hoisting rope attains its normal value, the excitation of the starting motor is reversed and the total voltage is raised, the hoisting rope thereby attaining its maximum value. The starting motor is actuated by the buffer motor connected on the primary station circuit; while the supplementary motor is in series with the buffer motor. The supplementary motor, by regulation of its excitation circuit, is designed to govern the speed of the buffer motor and thereby the speed of the buffer set, while the idea of the unit is to approximate a constant demand of about 300 h.p. on the generating station. In hoisting coal, the motors run at a speed of 38 r.p.m., producing a cage velocity of 26 ft. per second; this speed is reduced to 19 r.p.m., or 13 ft. per second, when men are being raised or lowered, and to 10 in. per second during inspection of the shaft.

CURRENT NEWS SUPPLEMENT

FEBRUARY 25, 1905.

RCTORY OF NATIONAL ENGINEERING SOCIETIES.

RICAN SOCIETY OF CIVIL ENGINEERS. ry, Chas. Warren Hunt, 220 West 57th ew York. Next meeting, New York, 1, 8:30 P. M.; paper by S. Waters Fox, hods of river improvement as developed t Missouri River from 1876 to 1903.

RICAN SOCIETY OF MECHANICAL ENGI- Secretary, F. R. Hutton, 12 West 31st ew York. Next meeting, New York. 2: Illustrated talk by W. R. Warner t conditions at Panama and the reasons ea-level canal.

RICAN INSTITUTE OF ELECTRICAL ENGI- Secretary, Ralph W. Pope, 95 Liberty ew York. Next meeting, New York, Feb. 24; papers by Ernest Gonzenbach, on ation of high-presure to electric rail-; by Geo. A. Damon, on high-pressure onstruction for electric railways; and H. Varney, on the high-pressure trolley.

ERICAN INSTITUTE OF MINING ENGI- Secretary, R. W. Raymond, 99 John ew York.

ERICAN INSTITUTE OF ARCHITECTS. tary, Glenn Brown, Washington, D. C.

SOCIATION OF ENGINEERING SOCIETIES. tary, John C. Trautwine, Jr., 257 South h St., Philadelphia, Pa.

ERICAN SOCIETY OF HEATING AND VENTI- G ENGINEERS. Secretary, W. M. Mackay, Vater St., New York.

NADIAN SOCIETY OF CIVIL ENGINEERS. tary, Clement H. McLeod, 877 Dorchester Montreal.

CIETY FOR THE PROMOTION OF ENGINEER- EDUCATION. Secretary, Prof. M. S. hum, University of Colorado, Boulder,

MERICAN SOCIETY FOR TESTING MATE- s. Secretary, Prof. Edgar Marburg, Uni- ity of Pennsylvania, Philadelphia, Pa.

MERICAN SOCIETY OF MUNICIPAL IM- EMENTS. Secretary, George W. Tillson, n 12, Municipal Building, Brooklyn, N. Y.

SSOCIATION OF RAILWAY SUPERINTENDENTS BRIDGES AND BUILDINGS. Secretary, S. F. rson, Concord, N. H.

MERICAN RAILWAY ENGINEERING AND NTENANCE OF WAY ASSOCIATION. Secre-, L. C. Fritch, 1562 Monadnock Block, Chi-. Annual meeting at Chicago, March 21, and 23.

MERICAN WATER-WORKS ASSOCIATION. Sec- ary, J. M. Diven, Elmira, N. Y.

MERICAN FOUNDRYMEN'S ASSOCIATION. retary, Richard Moldenke, P. O. Box 432, York.

NGINE BUILDERS' ASSOCIATION OF THE TED STATES. Secretary, J. L. Lyle, 39 tlandt St., New York.

THE CONDITION OF THE PANAMA CANAL.

Messrs. Wm. H. Burr and Wm. Barclay sons, engineering committee of the hmian Canal Commission, returned this k from Panama, and made the following tement concerning the conditions on the hmus:

'The committee on engineering of the hmian Canal Commission report that they nd the work generally in much better and re advanced condition than they antici-ed. In the great Culebra cut, the detail construction that will take the most time d most money, the chief engineer has in-lled and has at work three large American am shovels and is erecting five more. Four usand laborers are now at work on differ-t portions of the work and 1,000 more have eady been engaged in the West Indies and ntral America. Substantial progress is, erefore, being made. While on the Isthmus e committee was in daily conference with e chief engineer with a view to formulat- certain plans, contracts for which can be t at an early date.

"These plans and the accompanying data ll be submitted to the commission at Wash-gton. At Panama and Colon the laying of wers and water pipes is progressing steadily, so that in the near future both these cities will for the first time be furnished with a system of sewers and water supply with an abundance of wholesome water. The presence of yellow fever is to be regretted, but was to be expected, as this disease is always present in tropical countries in America unless long-continued sanitary precautions have been taken.

"Prior to the sanitary work of the commission no precautions or scientific measures have been taken on the Isthmus to guard against this disease. The same medical officers who succeeded in eliminating the fever from Havana are now repeating the crusade in Panama. Beyond any question equally successful results will be produced. At the present time there is nothing approaching an epidemic, and the conditions are greatly improved over those found in previous years.

"Some newspaper reports from the North were much exaggerated. The committee returned more than satisfied with the general conditions of the enterprise, and believes that completion can be attained in less time than is popularly supposed. Some time has been of necessity devoted by the engineering staff to the study and investigation of certain details not fully determined by the French. This preliminary work is now really ended, and the actual work of construction on a large scale can soon be begun."

A LARGE EYE-BAR.

The accompanying illustration has been engraved from a photograph of one of the largest eye-bars ever made. It was forged at Phoenixville, Pa., at the shops of the Phoenix Bridge Co., and was broken in its 1,200-ton testing machine. Bars of this size will be used in the 1,800-ft. cantilever bridge over the St. Lawrence River at Quebec, which is now being fabricated in the company's shops.

The bar is 16x2 in., the eye 36 in. in diameter, and the pin-hole 14 in. in diameter. In the test, the bar developed an ultimate strength of 52,450 lb. per square inch, and 30,650 lb. **elastic limit.** The elongation in 7 ft. was 22.3 per cent., the elongation of the pin-hole 6.8 in., and the reduction in area at the point of fracture 43.1 per cent. The bar broke in the body, and showed about 50 per cent. silky fracture.

THE CROTON AQUEDUCT COMMISSION.

MAYOR MCCLELLAN'S LETTER TO THE MERCHANTS' ASSOCIATION CONCERNING ITS CHARGES AGAINST THE COMMISSION.

I have the honor to state that I have given to your communication of March 18th last, which purports to contain charges and specifications against the Aqueduct Commissioners, as well as to the papers and briefs connected therewith, patient and searching examination. I have likewise read carefully the voluminous record of the hearing on your complaint before the Aqueduct Commission, and in order to enable me to give more intelligent consideration to the subject, I have made several visits, to both the Jerome Park and Croton Aqueducts.

Your request that my examination should be speedy could not be complied with literally, because the subject was one of such great proportions that it required much time which could only be given at intervals between other more pressing official duties.

My predecessor, Mayor Low, had virtually the same complaint presented to him by your association, and after much deliberation, declined to entertain the charges upon two general grounds.

The first of these was the lack of power in the Mayor, and the second is best expressed in his own words, as follows:

"The inevitable effect of the procedure you propose would be to delay still further the completion of these important structures, so vital to the water system of New York, for it would divert the time, the thought and the attention, both of the Aqueduct Commissioners and of the engineering force of the commission from the work to be done, to a tedious investigation of matters that have long been in dispute, and that have lost, through passage of time, whatever importance they may have originally had. Some of these matters of which you write, I know of only by hearsay. Of others, I know by personal knowledge. I must frankly say that I do not perceive in the two letters you have addressed to me on this subject, any substantial basis for the action you propose. I do not recognize all the elements of an engineering controversy that has been on ever since the first chief engineer of the commission, Mr. Fteley, was so unfortunately obliged, by reason of illness, to lay down this work. So far as this aspect of the case is concerned, I am not sanguine enough to believe that any inquiry will settle it. Partisans of the two sides will remain partisans to the end of everything. So far as the Aqueduct Commissioners are concerned, they have acted in every instance in which you criticised them, upon the advice either of the Chief Engineer or of the then Corporation Counsel. Those who see in their actions a sinister motive now, would do so despite all inquiry. As I have been working with them for a year, it is proper that I should say that I am far less disposed to assume that attitude today than I might have been had I known of their work only from the outside. It is due to them, I should say, that their work has impressed me as an exofficio member of the Board as conscientious, painstaking and intelligent."

A LARGE EYE-BAR.

What ever question might be urged to raise a doubt on the subject, I would hesitate to take the first ground for inaction mentioned by Mr. Low, but I must say that after my examination I agree generally with the reasons which form his second ground, and therefore advise you that I am constrained to take the same position with reference to your complaint, as that taken by Mr. Low with reference to the charges which you preferred to him.

There is, however, another view of the case which, in my judgment, is important. Even if it should be conceded that the Mayor had, without dispute, the power to hear and remove the Commissioners (and this is the end which is sought), it is quite clear that he could not exercise that power effectually without the approval of the Governor of the State. In order that this approval should be had it would be necessary to submit to the Governor the entire record of any hearing which might be had. Such a necessity would involve a hearing practically as complete as a judicial proceeding, and the finding resulting therefrom, it is reasonable to expect, could not hope for the approval of the Governor, unless it was based on something more substantial than opinion testimony or disputed questions of fact. Such a hearing would require that the Mayor should abandon practically every other duty, and for months perhaps sit as a judge in a proceeding, a preliminary examination of which appears to me, as it did also to Mayor Low, to give little promise of any conclusive result. After such a hearing would be terminated the question would be, whether from any indisputably established facts it could be said that the Commissioners were lacking in capacity to discharge the duties of their office, or had neglected to properly discharge them. Furthermore if, after such a proceeding, I should find them guilty, the Governor, on a review of the case, might properly take a different view, and all the time and energy would have practically gone for naught.

I state these two specific possible findings, because your complaint is so artlessly drawn that I am not quite sure what allegations are intended for charges, and what for specifications, but I take it that its general design was to make as charges, two propositions: First, that the Commissioners lacked capacity, and second, that the Commissioners had neglected their duty.

Every other statement therein contained, I assume, was made for the purpose of serving as specifications to sustain these propositions.

I assure you, in reaching this conclusion, I am not insensible of the effort, and the time which has been expended by your association in the endeavor to present these matters to the attention of my predecessor and myself.

I have no special tenderness for the Aqueduct Board. Its conception was in many respects unwise. It was made purposely a bi-partisan Board, and had committed to it by the legislature a great business proposition. The result has been just what might have been expected—that no administration could be held responsible for it and little supervision could be exercised by the City over its work. A scheme, the fulfilment of which would mean the establishment of a great water supply for the City, should naturally have suggested to its originators, the necessity of keeping it entirely free from any and all political parties.

It would be idle, however, to deplore what has been done, for the work of the Commission is now drawing to a close, and in the nature of things, should not last much longer. But it would be unprofitable at this time, so great is the need of more water for the City of New York, to put any obstacle in the way of the speedy prosecution and completion of its work.

I do not wish that this act of mine should be any discouragement to you, or to any other bodies striving for the City's betterment, because I assure you that the only purpose which I have in making this decision, is to seek what seems best at the present moment for the welfare of the public.

For the reasons stated above I am constrained to dismiss the charges preferred by your association.

THE LOS ANGELES-PACIFIC RAILROAD.

Owing to the greatly increased traffic on the interurban railway system of the Los Angeles-Pacific Railroad Company, the officers of that company have decided to increase the capacity of their central power-house at Vineyard, and to install an additional sub-station in Los Angeles. The new electrical equipment has recently been contracted for with the Crocker-Wheeler Company through its Pacific coast managers, the Abner Doble Company, of San Francisco. The contract comprises one 1,200-kw., three-phase, 50-cycle, 2,300-volt, engine-type generator with a speed of 125 r.p.m.; one 300-kw. motor-generator set; one 400-kw. motor-generator set; three 400-kw. transformers; three 160-kw. transformers; three 120-kw. transformers, and a 60-kw. engine-type exciter. The 1,200-kw. alternator will be of the Crocker-Wheeler Company's new revolving-field type, similar in construction to the three 4,000-kw. alternators recently ordered by the California Gas & Electric Corporation. The Los Angeles generator will be driven by a 2,000-h.-p. compound-condensing McIntosh & Seymour engine. The motor-generator sets will consist of 2,300-volt synchronous motors driving 600-volt direct-current railway generators. The transformers will be built for 15,000 volts on the primary and 2,300 volts on the secondary, and will be of the new water-cooled and oil-insulated type recently brought out by the Crocker-Wheeler Company.

The interurban railway system of the Los Angeles-Pacific Railroad Company is one of the most extensive in the country, embracing, as it does, nearly 200 miles of up-to-date lines. The company owes its growth largely to the energetic and untiring work of the president and manager, Mr. E. P. Clark, who was one of the pioneer railway men of Southern California, and who has seen his system develop from a very small beginning to its present commanding position in the traction field. The system extends from Los Angeles in a fan shape to Santa Monica, Ocean Park, Playa del Rey, Hermosa, Manhattan Beach, and Redondo on the ocean, and passes through the intermediate towns of Hollywood, Colegrove, Sawtelle, Sherman and Palms. In other words, the lines cover thoroughly the territory lying south of the Santa Monica Mountains and between Los Angeles and the ocean. Most of the lines have been double-tracked, and are constructed in conformity with the best steam railroad practice. About a year ago a new central steam plant was installed at Vineyard, about 5 miles west of Los Angeles, and from this station transmission lines at 15,000 volts carry the power to several sub-stations located at intervals over the system. It is to increase the capacity of this central station, and to supply additional power for the operation of the lines in Los Angeles, that makes necessary the additional machinery mentioned.

TRADE PUBLICATIONS.

W. H. Ellis & Co., general contractors, Cincinnati, Ohio, have issued several circulars showing different uses to which they have adapted reinforced concrete construction and the value of that material in fire-proof structures, as proved in practical tests and by the reduction of insurance rates.

The Westinghouse Machine Co., East Pittsburg, Pa., has sent out a catalogue which describes in detail the construction and operation of the Roney mechanical stoker. Over 1,000,000 h.p. of boilers have been equipped with this type of stoker, and a number of full-page cuts showing the more recent large installations are included in the catalogue.

The American Street Flushing Machine Co,. 25 Broad St., New York, was awarded a gold medal at the Louisiana Purchase Exposition for its street flushing machine. A catalogue published by this firm contains a full account of the manner in which these machines, which have the appearance of a street sprinking wagon, are operated.

The Cooper Hewitt mercury vapor electric lamp for electric lighting is described in Bulletin 5, issued by the Cooper Hewitt Electric Co., 220 West 29th St., New York. The qualities, efficiencies and the cost of installation for different requirements are given in this description.

W. H. Anderson & Sons, 21-31 St. Aubin Ave., Detroit, Mich., are now making a specialty of automobile and gas engine forgings. Crank shafts, connecting rods, hangers, and bevel-gear drives for these machines are explained in an artistic pamphlet recently issued by this firm.

George M. Callender & Co., Ltd., London, Eng., have issued a new illustrated catalogue of the bitumen Dampcourse, a compound used in waterproofing the foundations of buildings, manufactured by them. Mr. T. Hugh Boorman, 32 Broadway, New York, is the American representative of the firm.

The special features embodied in the Hercules fire hydrant made by The Holyoke Valve & Hydrant Co., Holyoke, Mass., are stated in a circular issued by that company. The hydrant is made in three styles, views of which are shown, and a description of an independent nozzel valve which can be applied to any hydrant is also given.

An interesting publication to manufacturers contemplating building new plants has just been issued by Mr. Luis Jackson, industrial commissioner of the Erie R. R., 21 Cortlandt St., New York. It gives a list of the many factories located on the Erie line during 1904, and explains in a concise way the advantages of the Erie territory.

BUSINESS NOTES.

The Smith & Thayer Co., 234 Congress St., Boston, has inaugurated an unusual guessing contest, closing Dec. 15, the prize being a steam or hot-water Winchester boiler able to heat a 15-room house. The terms of the contest are stated as follows: "There is a residence in Brookline, Mass., in which a hot-water heating apparatus is installed (open tank system) comprising two 'Winchester' boilers twinned together and covered with asbestos, one a 22-in. fire-pot, the other a 19-in. fire-pot, with 875 ft. of Rococo radiation in fourteen radiators, and 312 ft. in uncovered pipe and fittings. On Dec. 18, 1905, under the supervision of two Boston heating engineers, this apparatus will be run as follows: The temperature of the water in this apparatus will be allowed to cool to 80°, at which time the fires will be shaken down, and 100 lb. of fuel will be added to each heater. The dampers will then be adjusted and the fires allowed to burn themselves out. You are desired to estimate the elapsed time in hours, minutes, seconds, and fractions that the temperature of the water in the apparatus will keep above 80°. In other words, how much time must elapse before the water, starting at 80° with 100 lb. of new fuel, will return to the same temperature, with no adjustment of the dampers."

On March 1, the offices of the Bates & Rogers Construction Co. will be moved to the Ellsworth Bldg., 355 Dearborn St., Chicago.

The Harrisburg Foundry & Machine Works, Harrisburg, Pa., recently received, through their New York representatives, Mackenzie. Quarrier & Ferguson, an order for eight Fleming engines to be arranged for direct-connection to Worthington centrifugal pumps. The engines are to be installed in the power-house of the New York Central & Hudson River R. R. Co. at Yonkers and Port Morris.

The Mack Paving Co., Land Title Bldg., Philadelphia, is the lowest bidder on forty streets of vitrified brick paving with the Mack Mfg. Co.'s block in Philadelphia, amounting to approximately 85,000 sq. yd., bids for which were opened Feb. 17.

The contract for the erection and completion of the entire plant of the St. Croix Paper Co., on the St. Croix River, near Calais, Me., including the water power development, was awarded Feb. 16 to Frank B. Gilbreth, of New York, Boston and Baltimore. Geo. F. Hardy, 309 Broadway, New York, is engineer for the company. The plant will consist of sulphur storage, sulphur-burning, acid, digester, blower, screen, generator, pump, grinder, beater, boiler, finishing, machine and store buildings. With the exception of the store building, which is a frame structure, the entire plant will be of brick and steel. A long tail race is to be excavated in the ledge and two dams erected. Frank B. Gilbreth has the entire contract, and will handle all matters pertaining to the erection and completion of the plant.

The Penn Bridge Co., Beaver Falls, Pa., has, since the destruction of its plant by fire, made arrangements to lease a bridge plant at Carnegie, Pa., and is, therefore, in position to complete contracts which are on hand, and also to undertake any new contracts without delay. Plans for rebuilding have not been fully matured.

The Northern Engineering Works, of Detroit, Mich., have been awarded a contract for the electric travelling cranes required in the new plant of the Detroit Steel Casting Co. There will be one 30-ton, four-motor crane, and two 10-ton, three-motor cranes, all 70-ft. span. They have also secured contract for one three-motor, 5-ton special electric travelling crane from the Michigan Malleable Iron Co.

The Nordberg Mfg. Co., Milwaukee, announces that it has opened a New York office at 42 Broadway, in charge of Mr. F. W. O'Neil, mechanical and mining engineer.

Newspaper reports state that the Electric Storage Battery Co. has been awarded a contract by the New York Central & Hudson River R. R. for work aggregating $900,000, which calls for the equipment of several power-houses with electric storage batteries for use in operating the company's trains in and out of New York.

The following are among recent contracts awarded the Riverside Bridge Co., Wheeling, W. Va.: Schmulbach Bldg., Wheeling, 1,850 tons steel; a 2,000-ton bridge for the C., N. O. & T. P. Ry. Co.; bridge at Eagle Pass, Tex.; two bridges for New York State; a bridge for Allegheny Co., Md.; a trainshed for the Long Island R. R.; office and factory building for Wheeling Corrugating Co.; factory building for Tyler Tube & Pipe Co., Washington, Pa.; a number of smaller and less important contracts, amounting to about 6,000 tons. The company has sufficient contracts in hand to keep the plant in continuous operation for several months.

At the recent meeting of the stockholders of the Owego, N. Y., Bridge Co., the following directors were elected: E. S. McNaul, Wm. N. Conger, Thomas H. Reddish, E. R. Booth, Benn Conger, S. R. Ketchum and Clarence S. Mallory. The directors then elected as president of the company E. S. McNaul; vice-pres., Wm. N. Conger; secy. and treas., Thos. H. Reddish.

The Westinghouse Electric & Mfg. Co. has closed a contract for electrical equipment for another large cotton mill for Dwight Mfg. Co., Chicopee, Mass., having an equipment of upward of 130,000 spindles, comprising both ring spindles and mule spindles and about 3,500 looms. The electric power plant will be centrally located and the contract provides for one 440-volt 900-kw. A. C. generator, direct connected to a C. & G. Cooper 26 and 52x48-in. cross-compound condensing engine; one 25-kw. exciter direct-connected to Westinghouse engine, and one 22½-kw. motor-driven exciter. There will be two 200 h.p., six 100 h.p., three 75 h.p., three 50 h.p. and two 40 h.p. motors. The complete equipment of the new plant is from the plans of Messrs. Lockwood, Green & Company, of Boston.

PERSONAL NOTES.

Mr. F. W. Dalrymple has been appointed city engineer of Bayonne, N. J.

Mr. R. E. Gaut has been appointed engineer of bridges of the Illinois Central R. R.

Mr. Wesley Steele has joined the Ames Iron Works at the New York office, 85 Liberty St.

Mr. John W. Maxcy, of Houston, has been appointed engineer of roads, bridges and buildings of Harris County, Tex.

Mr. C. P. Nash, formerly mechanical engineer of the Pullman Co., has been appointed superintendent of the Standard Car. Co.

Mr. George C. Whipple delivered a lecture on filtration at Watertown, Feb. 10, under the auspices of the local chamber of commerce.

The Des Moines Society of Engineers has been organized with Mr. J. L. Van Liew as president, Mr. G. E. Dobson as vice-president, and Mr. E. Manhard as secretary and treasurer.

Mr. Wm. M. Jewell has opened an office in the Cable Building, Chicago, for practice as chemical and consulting engineer, giving special attention to water supplies, filtration and softening plants.

Mr. Edward Wegmann, expert engineer for the New York Aqueduct Commission, is to read a paper on the new Croton aqueduct, before the Municipal Engineers of the City of New York, on Feb. 28.

Mr. John I. Beggs, president and manager of the Milwaukee Electric Ry. & Light Co., has been elected president of the Union Electric Light & Power Co., and of the Laclede Gas Light Co., of St. Louis.

Mr. R. A. Billingham, formerly general master mechanic of the Pittsburg, Shawmut & Northern R. R., has been made superintendent of motive power of the same road, with headquarters at St. Marys, Pa.

Dr. Arthur W. Ewell, professor of physics at the Worcester Polytechnic Institute, has been appointed consulting engineer of the United Water Improvement Co., of Philadelphia, which is introducing a chlorine system in this country.

Norton P. Otis, chairman of the board of directors of the Otis Elevator Co., died at Yonkers on Feb. 20. When he was eighteen years old, he entered the elevator business established by his father, and assumed the management of it after his father's death.

Mr. Thomas Lawson has resigned as a director and manager of the Lawson Car Co. and become associated with Mr. George I. King, of the Middletown Car Works in the manufacture of the King-Lawson dump car. His offices will be at 32 Broadway, New York.

Mr. Dickinson MacAllister has resigned as president of the Metropolitan West Side Elevated Ry. of Chicago. He went to that city some years ago from the Brooklyn Union Elevated lines to superintend the construction of the South Side elevated road of Chicago.

Chas. W. Cross, formerly of the Roberts & Abbott Co., consulting engineers, of Clevelan O., and later electrical engineer for the Ea ern Ohio Traction Co., has entered the e ploy of Crocker-Wheeler Company, of A pere, N. J., and is attached to the Clevela office of the company at 816 New Engla Bldg.

Mr. T. C. Moorshead has resigned as chi engineer of the Illinois Terminal Ry., a Mr. B. B. Stakemiller has been appoint engineer maintenance of way of that roa with headquarters at Alton, Ill. Mr. Moor head goes to the Litchfield & Madison Ry., superintendent, with headquarters at Edward ville, Ill.

Mr. Frederick S. Cook has been promot from the position of assistant engineer to th of division engineer on the staff of Chief Eng neer J. Waldo Smith, of the Croton Aquedu Commission. He will have charge of the wo at Jerome Park reservoir. Mr. Alfred Flinn has been appointed assistant to th chief engineer, in immediate charge of d signs.

Mr. J. Edward Breen has been appoint city engineer of Cincinnati, to succeed t late H. J. Stanley. He served for a time the engineering corps of the Pennsylvan R. R., and then became county engineer, afte ward joining the city engineer's departmen He has been assistant city engineer sin 1901 and acting city engineer since Mr. Sta ley was stricken with paralysis.

The Connecticut Society of Civil Engineer at its annual meeting last week, elected th the following officers: President, Albert Hill; first vice-president, W. T. Spencer; se ond vice-president, Charles F. Chase; secre tary and treasurer, J. Frederick Jackson directors, Henry J. Kellogg and E. D. Graves the last two being re-elected to serve wit Frederick L. Ford and George K. Crandall.

Frederick John Warren, of Cambridge Mass., president of Warren Brothers Co., o Boston, died suddenly at Hotel Essex, Bostor Feb. 21. He is thought to have passed awa in his sleep. His business was in excellen condition, it is stated, but he had become ru down through overwork, though his famil and business associates did not consider hi condition serious. He was a son of the lat Herbert M. Warren, of Newton, Mass., an was born in that city Feb. 18, 1865, and had therefore, just passed his fortieth birthday.

After an illness of but three days, Phili G. Eastwick, of Portland, Ore., a civil an naval engineer, aged 67, died at Panama fro yellow fever on Feb. 1, while on a visit t his son, who is manager of the leading ban on the Isthmus. Born in Philadelphia 1838, he was the son of Andrew M. Eastwick the well-known engine builder, and who unde an imperial government contract, constructe practically the first railway in Russia. It wa here in the service of his father that M Eastwick's professional work commenced, an where he acquired a large part of the practica experience which later gave him reputation a a civil engineer. In the civil war he was chief engineer under Admiral Farragut, an was at Mobile and at the forcing of th blockade of New Orleans. At the close of th war he went to Oregon, and later to what wa then the territory of Washington. Seattle a that time was but a small port and settle ment, but with expectations; here he wa called upon to make the first survey of th prospective city and to establish street grade At the close of this work, in the seventies, h was in the service of the Northern Pacif R. R., making definite location for the mai line between the mouth of Snake River an Spokane Falls. In the early eighties, he wa assistant engineer in charge of constructio of the government jetty at the mouth of th Columbia River. Subsequently, he was charge of removal of obstructions in the Uppe and Lower Snake River in Idaho, and of th Okanogan and Upper Columbia Rivers Washington. In 1890-91 the important gov ernment survey for the proposed ship cana connecting Puget Sound with Lakes Unio and Washington was made under his directio In 1897 he had charge of the construction o defensive works at Admiralty Head, no known as Fort Casey, at the entrance to Puge Sound and remained there some years unt the completion of the main and mortar ba teries at that point. For the past few year his professional services have been employe on irrigation projects in Oregon and Idaho He was a prominent member of the Loya Legion of the United States, and was enginee officer with the rank of major on the staff o Governor Lord, of Oregon, during his ter of office.

RACTING NEWS

SPECIAL INTEREST TO

ORS, BUILDERS, ENGINEERS
MANUFACTURERS

ERING AND BUILDING SUPPLIES.

WATER.

nged Alphabetically by States.

Ala.—See "Power Plants, Gas ty."

Ark.—The Town Council is re- ve granted a water works fran- C. Warden.

rk.—The Rogers Water Co., of been incorporated, with a capital to construct and operate a sys- r pipes at Rogers. Incorporat- 'elker, F. F. Freeman, and others.

Cal.—Ransom Reid, Supt. Wa- writes that bids will be received for boiler and pump for water n Feb. 27 for pipe and hydrants; improvements, $100,000.

cisco, Cal.—The Eel River Power Co., has been incorporated with of $500,000. Principal place of n Francisco. Directors: F. D. an Rafael; H. B. Muir, Willits; aue, Ukiah, and others.

ns, Colo.—Holmes & Allen, of Den- ated to have secured the contract in the head works for the new , for $11,700. holders of the North Poudre Ir- . (B. D. Sanborn, Pres., Greeley), to have decided to expend about the enlargement of Clark's Lake include raising the embankment ling 38,000 yds. of new earthwork, g reservoir No. 15 in Dry Creek.

a, Colo.—The Dye Canal and Res- as been incorporated, with a capi- 00, by Jas. W. Beatty, Horace B. M. Dye, of Manzanola.

, Ga.—The citizens are reported to Feb. 8 to issue $10,000 bonds for uction of water works.

, Idaho.—The Water Co. is reported ided to expend about $25,000 in im- , including the purchase of a new a capacity of 850 gal. per minute, pump house and the extension of into Lake Coeur d'Alene.

Ill.—Bids are wanted Mar. 4 for and delivering to Dept. Pub. Wks. works shops all hydrant and stop- ings that may be required during ng Dec. 31, 1905. F. W. Blocki, . Wks. ncial budget is reported to contain iation of $4,000,000 for new water d increasing the water pressure in nt stations.

Ill.—The City Council on Feb. 20 ordinance providing for the laying 5 miles of water mains. Robt. M. y Clk.

Ill.—This city is reported to have plation the construction of water connection with its electric light in operation.

Ill.—The Council is reported to er consideration the securing of a supply.

, Ind.—See "Power Plants, Gas and y."

, Ia.—The Council is reported to ded to prepare plans and estimates lidating the light and water plant.

ines, Ia. —Local press reports state t 3 miles of water mains will prob laid in the 5th ward during the

la, Ia.—See "Power Plants, Gas tricity."

y, Kan.—See "Power Plants, Gas ricity."

t, Kan.—The citizens are reported to ed to issue $25,000 bonds to complete nt city water plant. It is proposed pipe line to Cedar Creek.

e, Kan.—It is stated that bids will ed until Mar. 15 for an 80,000-gal. tom steel tank to be erected on a teel tower. L. K. Green, Chmn. Wa- Comn.

nce, Ky.—John A. Crabb writes that posed to construct water works, at a 25,000 to $35,000. No engineer se- yet.

erling, Ky.—See "Power Plants, Gas tricity."

, Ky.—Granberry Jackson, of Nash- n., has made surveys and is working inary plans and estimates for water robable cost, $25,000.

La.—Bids are wanted Mar. 20, for truction of water works, as adver- The Engineering Record.

y, Mass.—Luther S. Herrick, City tes that it is proposed to construct a xtension of water works and sewer- m in consequence of location of Unit- Mfg. Co.

**Gloucester, Mass.*—Gow & Palmer, of Boston, are stated to have secured the contract for the construction of a pipe line under the canal (bids opened Feb. 9) for $26,000.

Marlboro, Mass.—Press reports state that Ransom & Hoadley, of Providence, R. I., who recently purchased the rights of the Salmon River Power Co. plan to build a reservoir in Marlboro, at a cost of $100,000; the company also expects to build a reservoir on Diamond Lake in Glastonbury, and strengthen the dam at Leesville.

Attleboro, Mass.—The Attleboro water supply bill is reported to have been signed by Governor Douglas, and will give Attleboro the power to issue $150,000 bonds for the purpose of enlarging its water system and making improvements.

Pittsfield, Mass.—The City Council is stated to have passed the ordinance providing for an issue of $76,000 water bonds.

Detroit, Mich.—Definite steps toward the establishment of a reservoir with a capacity of 500,000,000 gal. were taken by the Water Bd. on Feb. 8, when Engineer Clarence W. Hubbell's recommendation was referred to the committee on ways and means with instructions to secure options on ground, etc. Engr. Hubbell also presented a report to the Water Bd. recommending that the settling basin be cleaned and excavated to the depth of 20 ft., at an estimated cost of from $12,000 to $15,000 and that $178,810 be spent in extensions, $60,000 of the amount to be expended for new fire lines requested by the Fire Comr.

Alpena, Mich.—The citizens are reported to have voted Feb. 13, to purchase the plant of the Water Works Co. It is proposed to improve the system.

Melrose, Minn.—The Council is reported to be considering the question of constructing water works.

Duluth, Minn.—The City Engineer has been requested by the Bd. of Water & Light Comrs. to prepare plans and specifications for water and gas mains across Ship Canal, to cost $5,000; also plans and specifications for 5,000,000 gal reservoir at West Duluth, to cost $21,000.

Cleveland, Miss.—It is reported that bids will be received Mar. 4 by P. B. Woollard, Town Clk., for furnishing and laying 4,000 to 6,000 ft. 4-in. regulation water pipe; said pipe to be laid 18 in. deep from bottom of pipe.

New Albany, Ind.—See "Power Plants, Gas and Electricity."

Cambridge, Neb.—The Council is reported to be considering the advisability of installing water works.

Franklin, N. H.—The City Council has passed a resolution authorizing the Mayor and Treas. to borrow about $5,000 for an additional water supply. Engr. F. L. Fuller, of Boston, in his report says that with a pipe line across Pemigewasset River and a new reservoir, the water system would be much strengthened.

Santa Fe, N. Mex.—The Santa Fe Irrigation & Improvement Co. has been incorporated, by Fred. Muller, Elza G. Kanauer, L. Bradford Prince, and others, of Santa Fe, with a capital of $100,000, to build irrigation works 1 mile southeast of this city, taking water out of the Arroyo Chamisso.

Asbury Park, N. Y.—The following are the bids opened on Feb. 15 by the Dept. of Water & Sewers, (John L. Coffin, Supt.), for a 200-h.p. internally fired tubular boiler; (*a*) gross bid, (*b*) to be deducted for old boiler: Edw. Burhom, 71 Wall st., New York, N. Y., *a*, $4,880; *b*, $400; A. D. Granger, 95-97 Liberty St., New York, N. Y., *a*, $4,385; *b*, $200; W. B. Tucker, 46 W. Scott Pl., Elizabeth, N. J., *a*, $3,867; *b*, $100; Cleveland Steam Boile Works, Cleveland, O., *a*, $3,600; *b*, B. Franklin Hart, Jr., & Co., 143 Liberty St., New York, N. Y., *a*, $3,477; *b*, $50; David C. Seymour, 49 Lawrence St., Newark, N. J., *a*, $3,399; *b*, Penn. Engineering Co., 800 Perry Bldg., Philadelphia, Pa., *a*, $3,365; *b*, $200; Howard W. Read, 3d and Arch St., Philadelphia, Pa., *a*, $2,945; *b*, E. Keeler Co., 32 Broadway, New York, N. Y., *a*, $2,970; *b*, $200; The Brownell Co., Betz Bldg., Philadelphia, Pa., *a*, $2,787; *b*, $100; The Edward Hampson Co., 26 Cortlandt St., New York, N. Y., *a*, $2,725; *b*, $135.

Oswego, N. Y.—A bill is reported to have been introduced in the State Assembly at Albany, enabling the city of Oswego to issue $200,000 bonds for the purpose of installing a lake water system.

New York, N. Y.—Bids will be received Mar. 8, by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing and delivering 1,050 four nozzle post hydrants and 40 two nozzle fireboat connection hydrants for high pressure fire service mains in Manhattan and Bronx boroughs.

Syracuse, N. Y.—The following are the bids reported opened on Feb. 14, by the Bd. of Contract and Supply, for (*a*) 365 tons c. i. pipe from 6 to 12 in. diam., per ton; (*b*) 9 tons special castings, per lb.; (*c*) total: Chas. Miller & Son Co., of Utica, *a*, $26.35; *b*, 2½ cts.; *c*, $10,068. The Camden Iron Wks., *a*, $26.70; *b*, 2¾ cts.; *c*, $10,359. C. T. Hookway, *c*, $10,507.

Callicoon Depot, N. Y.—Bids will be received until Mar. 16 by the Callicoon Water Co., for furnishing material and constructing a system of water works here, consisting of a reservoir, catch-basin, intake dam and filter bed, and about 9,000 ft. of 2 to 8-in. water main, etc. E. W. Moxley, Engr., Jefferson, N. Y.; Chas. A. Thorwelle, Secy.

Niagara Falls, N. Y.—Mayor Cutler is stated to have submitted to the Bd. of Pub. Wks. a communication as to the cost and details of improving the pumping plant, recommending that the city engineer be directed to ascertain the amount of water now being pumped; the cost of installing a new pump with a capacity equal to 50 per cent. more than the present requirements, including new turbines and connecting machinery; the cost of installing a second pump of equal capacity to be run by water power; the cost of each of the above if run by electric power; the cost of lowering the turbines to get full head provided for in contract between city and Hydraulic Power & Mfg. Co., to report on merits and cost of a slow sand filtration plant, and other processes; cost of enlarging present or erecting new building for the pumping machinery; to advise what portion of old machinery, if any, be retained; estimated cost of erecting an electric plant; to operate plant, and cost of laying a water main to connect a pumping station with present system of mains.

Greensboro, N. C.—The Bd. of Aldermen is stated to have on Feb. 14 sold bonds as follows: $100,000 for water works; $75,000 for sewers, and $75,000 for street improvements.

Cleveland, O.—Bids will be received by the Bd. of Public Safety, on Mar. 13, for furnishing and delivering all stop cock boxes and parts of same that may be required during the year 1905, as advertised in The Engineering Record.

Cincinnati, O.—Bids will be received Mar. 14, by the Bd. Pub. Service, for furnishing and delivering water pipe, water pipe specials and loam castings. Geo. F. Holmes, Clk.

Belleville, O.—E. K. Gardner, of Shreve, owner of the electric light plant, has in contemplation the construction of water-works. L. M. Gardner, Mgr., Belleville.

Geneva, O.—The Council is stated to have passed an ordinance providing for a bond issue of $10,000 for water-works extension. It is proposed to extend the water mains on 8 streets.

Sandusky, O.—Bids are wanted Mar. 17 for $7,500 Monroe St. water main extension bonds. Alex. M. Wagner, City Aud.

Bucyrus, O.—Henry B. Smith, Treas. Bucyrus Development Co., writes that it is proposed to install a filtration plant in connection with the water works at a cost of $15,000.

Helena, Okla. Ter.—The House is reported to have passed a bill authorizing the voting of $20,000 bonds for the construction of water works.

Enid, Okla. Ter.—The City Council is stated to have on Feb. 0 sold $50,000 water works bonds.

Wickford, R. I.—Thos. J. Peirce, Secy. Wickford Light & Power Co. writes that the company has in contemplation the construction of water works.

Marion, S. D.—See "Power Plants, Gas and Electricity."

Nashville, Tenn.—The City Council has passed on second reading the ordinance appropriating $25,000 for purchasing and laying water pipe and fittings, and $5,000 for purchasing water meters.

Memphis, Tenn.—Bids will be received Feb. 28 by Lawrence Simpson, Gen. Supt. Memphis Artesian Water Dept., for furnishing 5 electric alternating current motors to operate certain pumps of said Water Dept., 1,000 five to eight-in. meters with proper connections f. o. b. and 1,000 c. i. meter boxes to be delivered at office of Dept.

Anahuac, Tex.—The Lone Star Canal Co. of Anahuac, has been incorporated with a capital of $300,000, to construct and operate an irrigation system. Incorporators: T. O. Emerson, Titusville, Pa.; Bert. H. Collins, Bradford, Pa.; B. R. Garland, and F. M. Hamilton, of Anahuac, and others.

Springville, Utah.—It is stated that plans and specifications are being prepared for water works, to cost about $10,000.

Barton Heights, Va.—The citizens are reported to have voted Feb. 9 to issue $15,000 bonds to extend water mains and sewers, pave sidewalks and for equipment of fire department.

Blaine, Wash.—The W. I. Carpenter Lumber Co. is reported to have petitioned for a franchise for water works.

North Yakima, Wash.—Press reports state that the Northwest Light & Water Co. will expend about $250,000 on an almost entirely new water system.

Seattle, Wash.—The City Council has passed an ordinance providing for the laying of a water main on 24th Ave., to cost $3,000. Bids will be received Mar. 4 by C. B. Bagley, Secy. Bd. Pub. Wks., for laying a water main in Dorffel Drive; probable cost, $5,300.

Bellingham, Wash.—It is stated that bids will be received until Mar. 2 by the City Compt. for furnishing c. i. water pipe and fittings.

Milwaukee, Wis.—Bids will be received Mar. 7 by the Bd. Pub. Wks. for furnishing material and constructing foundation of engine No. 5 at North Point pumping station of Milwaukee Water Wks., on shore of Lake Michigan, near North Ave. Chas. J. Poetsch. Chmn.

Appleton, Wis.—The Water Wks. Com. is reported to have submitted a report to City Council, recommending that the city issue $250,000 bonds for the construction of water works.

Ft. D. A. Russell, Wyo.—It is stated that bids will be received until Mar. 7 by Capt. W. S. Scott, Q. M., U. S. A., Cheyenne, for extensions to water system at Ft. D. A. Russell, Wyo., consisting of 370 ft. 6-in. and 340 ft. 4-in. c. i. pipe, and 2 fire hydrants.

Havana, Cuba.—It is reported that bids are about to be received for 4,487,200 lbs. pipe and 39,000 lbs. specials for the new city water works.

Winnipeg, Man.—Bids will be received by the Chairman Fire, Water & Light Com., on Mar. 13, for a supply of brass goods and pipe fittings, etc., as advertised in The Engineering Record.

Toronto, Ont.—Bids will be received by Thos. Urquhart (Mayor), Chmn. Bd. of Control, on Mar. 21 for the construction of either a 5 or 6-million imperial gallon triple-expansion flywheel pumping engine, as advertised in The Engineering Record.

North Bay, Ont.—It is stated that bids will be received until Mar. 20 by M. W. Flannery, Town Clk., for various works in connection with the change of the source of the water supply and installing of a system of sewers and their appurtenances. The system of water works comprises the following: Laying 15,000 ft. 10-in. c. i. delivery pipe, with necessary valves, etc., with 330 ft. 12-in. intake pipe; new pumping station of brick, 60 x24 ft., and engineer's brick veneered residence; supply and erection of 75-h.-p. boiler; steel stack, 30 in. diameter, 60 ft. high; removal and re-erection of present plant; the sewer system consists of supplying and laying 20,000 ft. of 8, 10 and 12-in. sewer pipe with manholes, flush-tanks, etc., and 2 concrete septic tanks, each 100 to 40 ft. L. O. Clarke, Town Surv.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—It is stated that bids will be received until Mar. 6 for building storm water sewers in Whitman St. R. S. Williams, City Treas.

Talladega, Ala.—The City Council is stated to have appropriated $5,000 for the extension of the sewerage system into Stoneington.

Ft. Collins, Colo.—Press reports state that the City Council will, on Mar. 1, award a contract for the construction of new sewers.

Cartersville, Ga.—See "Power Plants, Gas and Electricity."

Danville, Ill.—The City Council has passed an ordinance providing for the construction of a sewer bet. Oak and Gilbert Sts., to cost $5,039.

Peoria, Ill.—The Bd. of Local Improvements is stated to have adopted the Engineer's estimate on the new sewer for South St. to cost $58,009.

Des Moines, Ia.—Bids will be received by the Bd. of Pub. Wks. Mar. 11 for constructing the Ingersoll Run sewer, as advertised in The Engineering Record.

**Topeka, Kan.*—Jas. F. McCabe, City Engr., writes that the following are the bids opened on Feb. 6 for the construction of brick and pipe sewers; (*a*) Hanley & Ritchie, Iola (awarded contract); (*b*) M. Cook & Son, Junction City; (*c*) Brooks and Gilmore, Topeka:

Pipe sewers:	**a.*	*b.*	*c.*
19,369 ft. 8-in. ...	$0.87	$0.90	$0.90
475 " 10-in. ...	.88	.90	1.01
4,821 " 12-in., ...	1.20	1.25	1.16
4,863 " 15-in.	1.32	1.35	1.37
2,993 " 18-in.	1.66	1.75	1.65
862 " 21-in.	2.32	2.40	2.44
1,700 " 24-in. ...	3.10	3.00	2.78
3,630 " 27-in.	3.10	3.25	3.77
650 " 30-in. ...	3.90	3.60	4.64
1,350 ft. 30-in. brk† ..	3.54	3.00	3.77
3,800 " 1-in. galv pipe	.25	.25	.24
75 manholes	53.00	55.00	52.30
47 inlets or lamphls	14.00	15.00	15.66
10 flushing tanks..	65.00	65.00	75.40
20 M. ft. lumber..	30.00	30.00	23.20
Rock excavation:			
1,500 yds. loose	.75	.75	.75
3,700 " solid	3.15	3.25	3.50
Total	$79,892	$80,225	$84,588

†2-ring.

Beverly, Mass.—See "Water."

Lawrence, Mass.—The Bd. of Aldermen has passed an order for an issue of $100,000 bonds for the construction of 3 main sewers. This work will probably not be let by contract, but will be done under supervision of Paul Hannagan, Supt. of Sts.

Lansing, Mich.—Bids will be received by the City Clk., on Feb. 27 (readvertisement) for constructing the Weinman Creek alley sewer, in Pine, Madison and other streets, comprising 234 ft. of 26x39-in. and 245 ft. of 22x33-in. and 3,176 ft. of 42x63-in. brick sewers, including 23 catch basins and 7 manholes; cost, $19,900.

Gulfport, Miss.—Bonds to the amount of $45,000 are reported sold to be used for sewerage and a city hall.

**St. Louis, Mo.*—The following are the lowest bids opened on Feb. 14, by the Bd. of Pub. Improv, for the construction of 7 sewers: Glaize Creek Sewer Dist., No. 2, Robt. Wycoff, $4,199; E. 13th St. Dist., No. 5, Fred Hoffmann & Co., $9,645; Rocky Branch Sewer Dist. No. 12, Geo. J. Prendergast Constr. Co.., $4,020; Manchester Road Sewer Dist., No. 1, McIntyre-Teese Constr. Co., $31,709, and 9th Dist. Sewer, Prendergast Constr. Co., $6,773 (awarded contract).

**Items marked thus give the names of parties awarded contracts.*

Newark, N. J.—Engr. Edw. S. Rankin is stated to have submitted to the Sewer Com. of Bd. of Wks., plans for a sewer system in the Parkview section and the Weequahic Park tract, the cost of which is estimated at about $80,000. The territory it is proposed to drain consists of about 320 acres. The main sewer pipe will run through Hunterdon St. to Lyons Ave., east to Elizabeth, north to Lehigh Ave. Here it is proposed to construct a brick sewer to Hillside Ave., to Watson Ave., to Meeker Ave., where this system will connect with the proposed Parkview sewer.

Binghamton, N. Y.—The Common Council has adopted a resolution directing the City Engr. to prepare plans for a sewer on Court St., from Liberty St. eastward to connect with the Asylum sewer.

Buffalo, N. Y.—Bids will be received Mar. 2, by the Dept. of Pub. Wks., for constructing 10 and 12-in. tile sewers in portions of 4 streets. Francis G. Ward, Comr.

Greensboro, N. C.—See "Water."

Columbus, O.—Bids will be received by the Bd. of Pub. Service, on Mar. 8, for furnishing labor and material for building a main sewage pumping station, as advertised in The Engineering Record.

Cincinnati, O.—Bids will be received Feb. 27, by the Bd. Pub. Service, for furnishing material and constructing sewers and drains in a portion of Palm Ave. Geo. F. Holmes, Clk.

Cleveland, O.—Bids will be received Mar. 2, by the Bd. Pub. Service, for constructing sewers in portions of Willson Ave., Berghoff, Carabelli, Fleet and Norwood Sts. A. R. Callow, Secy.

Akron, O.—City Engr. Payne estimates the cost of constructing a sewer on the Wolf Ledge run at $39,750.

Elyria, O.—Plans are reported to have been adopted for a sewerage system on the east side, to include a main sewer down Washington Ave.

South Sharon, Pa.—The Boro. Clk. writes that the contract for sewer work was awarded in October, and no more sewer work is contemplated.

Galveston, Tex.—The following are the bids opened on Feb. 15 for the construction of a 36-in. vitrified drain along 18th St. (bidders of Galveston, unless otherwise mentioned): Galveston Gas Fitting & Plumbing Co., $5,626; W. I. Heffron, $5,628; J. C. Kelso, $5,678, and E. G. Trueheart, San Antonio, Tex., $6,052.

*J. C. Kelso, of Galveston, secured the contract for constructing the 33d St. sewer (bids opened Feb. 15), at $5.81 per lin. ft. for 1,450 ft. 36-in. pipe, and for 2 manholes, ea. $50; total cost, $8,524.

Milwaukee, Wis.—Bids will be received Mar. 3 by the Bd. Pub. Wks. for furnishing 4 c. i. wheel blades for screw pumping engine of Milwaukee River Flushing Wks., on shore of Lake Michigan, at head of Kane Pl. Chas. J. Poetsch, Chmn.

North Bay, Ont.—See "Water."

BRIDGES.

Notes Arranged Alphabetically by States.

Bentonville, Ark.—It is reported that bids will be received Mar. 25 by Marion Douglas, Co. Clk., for constructing 2 steel bridges, one over Sargon Creek and the other over Osage River.

**Lodi, Cal.*—M. B. White is stated to have received the contract for constructing a bridge at New Hope Landing near Lodi, for $7,210.

Willimantic, Conn.—The Bd. of Aldermen is stated to have passed a resolution authorizing the Mayor to appoint a committee to procure plans, etc., for the construction of a foot-bridge at Main St., the structure not to cost more than $12,000.

Bridgeport, Conn.—A. B. Hill, of New Haven, is reported to be engineer in charge of the construction of a concrete arch to be constructed over Ash Creek, between Bridgeport and Fairfield; estimated cost of work complete $25,000.

Washington, D. C.—Bids will be received by Col. Smith S. Leach, Corps Engrs., U. S. A., on Mar. 23 for the construction of an earth embankment approach to highway bridge across Potomac River, as advertised in The Engineering Record.

The Senate is stated to have passed a bill providing for an appropriation of $20,000 for the construction of a bridge over Piney branch.

Bonner's Ferry, Idaho.—D. C. Corbin, of Spokane, Wash., is reported to be the promoter of the proposed bridge to be constructed over Kootenay River, at Bonner's Ferry.

St. Anthony, Idaho.—It is stated that bids will be received by the Co. Comrs. until Mar. 6 for constructing 3 county bridges. Victor Hegsted, Co. Clk.

Chicago, Ill.—The financial budget is reported to contain an appropriation of $1,888,000 for bridges. New bridges are to be built at Archer Ave., N. Halsted St., Erie St., Kinzie St., North Ave., Indiana St., Chicago Ave., Torrence Ave., and Canal St.

Albion, Ind.—It is reported that bids will be received Mar. 7 by John L. Henry, Co. Aud., for constructing 3 steel and concrete bridges.

Crawfordsville, Ind.—It is stated that bids will be received until Mar. 15 for constructing an iron bridge across Coal Creek and a double cement arch at Danville. Jas. A. Harding, Co. Surv.

Wabash, Ind.—Bids will be received Apr. 6 by W. S. Davis, Co. Aud., for constructing a concrete or steel bridge on boundary line over Eel River near Town of Stockdale.

Crawfordsville, Ind.—The Northwestern Traction Co. is preparing to construct a viaduct over the Vandalia Railroad tracks at the city limits.

Mt. Vernon, Ind.—It is reported that bids will be received Mar. 6 for constructing 6 bridges. S. G. Howard, Co. Aud.

Des Moines, Ia.—Bids will be received Mar. 8 by the Bd. Pub. Wks. for constructing a 6-ft. concrete steel culvert on University Ave. over branch of Walnut Creek. W. W. Wise, Chmn.

Barbourville, Ky.—It is stated that the concrete bridge of the Bell Jellico Coal Co., crossing the Cumberland River, has been destroyed by the flood.

**Shreveport, La.*—M. L. Lynch, of Tyler, Tex., Ch. Engr., Shreveport Bridge & Terminal Co., writes that bids have been received for constructing the proposed bridge across the Red River at Shreveport, and the contract for constructing the substructure has been awarded to the Missouri Valley Bridge Co., Leavenworth, Kan. Total cost of the bridge will be about $250,000.

Manistee, Mich.—Bids are wanted Mar. 30 for removing present drawbridge over Manistee River at Maple St., and for constructing a new drawbridge, approaches, substructure and protection work. Bids will be received on bascule and other types of truss and deck girder swing bridges, and contractors may also submit plans with bids. Specifications may be obtained for $1. C. A. Gnewuch, City Clk.

Minneapolis, Minn.—Bids will be received Mar. 6 by the Bd. Co. Comrs. for rebuilding Bridge No. 16, Town of Orono. Hugh R. Scott, Co. Aud.

West Point, Miss.—It is reported that bids are wanted Mar. 6 for constructing a 142-ft. bridge over Little Crane Creek, on West Point and Pine Bluff Road in Dist. 5. S. A. Deanes, Chancery Clk.

Yazoo City, Miss.—It is reported that bids will be received Mar. 6 by the Bd. Co. Supervs. for constructing a steel bridge over Beaver Creek in Beat 1. S. S. Griffin, Clk.

Linneus, Mo.—It is stated that bids are wanted Mar. 1 by T. L. McMichael, Co. Surv., for repairing bridge across Raritan Branch; also for building a new bridge between Linn and Adair Counties.

Columbus, Neb.—It is reported that bids will be received Mar. 1 by John Graf, Co. Clk., for constructing all county bridges that may be needed for 1 year.

Perth Amboy, N. J.—According to reports the Central R. R. of New Jersey (Jos. O. Osgood, Ch. Engr., Jersey City) will construct a bridge over Raritan River between Perth Amboy and South Amboy, at a probable cost of $500,000.

Passaic, N. J.—F. M. Stillman Co., of Newark, is stated to have withdrawn their bid for constructing a drawbridge at Gregory Ave. (bids received Sept. 12). According to reports, the County Bd. of Freeholders has not decided as yet to receive new bids.

**Port Chester, N. Y.*—John O. Merritt is stated to have received the contract for constructing a stone bridge over the creek on the shore road, leading to Belle Haven, for $9,000.

New York, N. Y.—Bids will be received Mar. 2 (readvertisement) by Geo. E. Best, Comr. of Bridges, for constructing lattice railing on footwalks of Williamsburg bridge bet. Boro. Manhattan and Brooklyn.

Gouverneur, N. Y.—N. Walter Lee, Town Clk., writes that it is proposed to construct a bridge over Oswegatchie River at Main St., to cost $18,000. Engineer, C. F. Stowell, Albany.

Dayton, O.—The construction of a bridge over the Great Miami River at Washington St. is reported under consideration. Probable cost $120,000.

Youngstown, O.—It is stated that the Erie R. R. Co. (W. L. Derr, Acting Ch. Engr., New York, N. Y.) is having plans prepared for an overhead bridge to be constructed at Ardale St.

Portsmouth, O.—R. D. York, of Portsmouth, Vice-Pres. and Gen. Mgr., Portsmouth St. Ry. & Light Co., writes that bids will be received within 30 days for the construction of a bridge over its tracks on 10th St., to cost from $10,000 to $12,000.

Klamath Falls, Ore.—It is stated that bids will be received until Mar. 1 by the Co. Comrs. for constructing a bridge 134 ft. long, and 16 ft. wide, across Lost River. Geo. Chastain, Co. Clk.

Bristol, Va.—It is stated that the Norfolk & Western Ry. Co. (C. S. Churchill, Ch. Engr., Roanoke) will construct an iron bridge over the railway tracks on Mary St., at a cost of $5,000.

Kalama, Wash.—It is stated that bids will be received by the Co. Comrs. until Mar. 3 for constructing a county bridge across Coal Creek. G. H. Thayer, Co. Aud.

Toronto, Ont.—It is proposed to make improvements, additions and extensions to the Don River Bridge at Queen St., at a cost of $200,000. C. H. Rust, City Engr.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The Bd. of Pub. Wks. is stated to have adopted specifications for the paving with asphalt on Mission St.; probable cost, $80,000.

Canon City, Colo.—Plans and specifications for sidewalks, crosswalks, and street improvements in Dists. Nos. 3 and 4, which call for about 196,000 sq. ft. sidewalk, and 6,200 lin. ft. crosswalks, are now ready and will be forwarded to interested bidders upon request. Bids will probably be asked for about Apr. 17. Address W. R. Smythe, City Engr.

Farmington, Conn.—The construction of a highway between Farmington and Hartford is reported under consideration; estimated cost of proposed improvement is $30,000.

Washington, D. C.—The following are the bids opened on Feb. 18 for grading 14th St. extended—*a*, Sect. No. 1; *b*, Sect. No. 2 (C. B. Hunt, Engr. of Highways): Strauther & Colvin, Culpepper, Va., *a*, $10,800; *b*, $15,600. G. B. Mullen, Washington, *b*, $15,275. E. Saxton, Washington, *a*, $19,800; *b*, $28,600. E. G. Gummel, Washington, *a*, $13,050; *b*, $18,850. L. R. Colbert, *b*, $22,100. Chas. McDermott, Philadelphia, Pa., *a*, $11,250; *b*, $16,250. J. J. Moeds, *a*, $21,275. G. McDonald, Orange, Va., *a*, $10,350; *b*, $17,550. Douglas, Gilmore & Co., Baltimore, Md., *a*, $17,100; *b*, $24,700.

Jacksonville, Fla.—The following bids are stated to have been received Feb. 13 by the Bd. of Pub. Wks. for grading about 37,800 sq. yd. for furnishing and laying about 37,800 sq. yd. vitrified brick or block and 21,100 lin. ft. stone curbing on portions of several streets (price given per sq. yd.): Augusta paving block, E. G. Billingsley, $1.38; John N. C. Stockton, $1.44⅞; Geo. R. Foster, Jr., $1.46½; F. W. Long, $1.53½, and Wm. F. Bowe, of Augusta, Ga., for Graves shale block, $1.58; Wm. T. Cotter, of Jacksonville (no block mentioned), $1.63; McGovern Constr. Co., of Trenton, N. J., for Jas. Porter block, $2.06; for Shawmut block, $2.05; for Pennsylvania Clay Co.'s block, $2.03.

**Savannah, Ga.*—The Streets and Lanes Com. of Council is stated to have awarded the contract furnishing 30,000 sq. yd. of vitrified brick to the Georgia Vitrified Brick & Clay Co., at 92 cts. per sq. yd., and to the Graves Shale Brick Co., at 94 cts. per sq. yd., each receiving contract for supplying 15,000 sq. yd. (bids opened Feb. 14).

Paris, Ill.—It is stated that the City Engineer has prepared plans for paving with brick portions of several streets, at an estimated cost of $16,382.

Danville, Ill.—The City Council is stated to have passed an ordinance providing for the graveling and paving of Chandler St., at an estimated cost of $18,835.

Chicago, Ill.—The financial budget is reported to contain an appropriation of $200,000 for roadways in undeveloped territory in the city. Stone will come from the Bridewell.

**East St. Louis, Ill.*—The contract for 1,546 ft. combination curb and gutter, and 2,620 sq. yd. vitrified brick pavement on 14th St. (bids opened Feb. 18) has been awarded to McCabe & Co., 411 Olive St., St. Louis, Mo., for $5,439.

**Mattoon, Ill.*—The Bd. of Local Improvements is stated to have awarded to Loomis & Roe, contracts for paving Wabash and Charleston Ave., at $7,542 and $9,543 respectively.

**Indianapolis, Ind.*—H. Brown, Chmn. Bd. Park Comrs., writes that the contract for erecting Fall Creek Boule., from Capitol to Central Ave. (bids opened Feb. 10) has been awarded to the Moore-Mansfield Constr. Co., of Indianapolis, for $67,950, subject to the approval of the benefit assessment roll, necessary to fully complete proposed work.

Rensselaer, Ind.—It is reported that bids will be received Mar. 15 by the Co. Comrs. for constructing 5½ miles gravel roads. J. N. Leatherman, Co. Aud.

Bedford, Ind.—Bids will be received Mar. 13 (change of date) by the Co. Comrs. for constructing the following gravel and macadamized roads in Marshall Township: Trogden Lane, length 7,060 ft.; Guthrie and Limestone Road, 12,825 ft.; Peerless Road, 16,786 ft.; Guthrie and Bartlettsville Road, 4,666 ft.; the Dunn-Anderson branch of the Peerless Road, 4,760 ft.; Brinegar Lane, 2,800 ft. Anselm Wood, Chmn.

Des Moines, Ia.—Bids will be received Feb. 28 by the Bd. Pub. Wks. for paving with vitrified brick on 6-in. concrete foundation with Portland cement top filler portions of 2d and School Sts., in all about 3,954 sq. yd. W. W. Wise, Chmn.

**Topeka, Kan.*—Contracts for paving (bids opened Feb. 6) have been awarded as follows: To Haskins & Ramsey, Topeka, for 340 cu. yd. grading, 30 cts. per cu. yd.; 153,000 cu. yd. overhaul, 1 ct. per cu. yd., and 1,063 sq. yd. brick paving, $1.12 per sq. yd. To J. H. Maxwell, Topeka, 23,576 sq. yd. rolling subgrade, 1.9 cts. per sq. yd. To Webster & Tuloch, Topeka, for 12,633 lin. ft. curb (Ft. Scott blue sandstone), 50 cts. per lin. ft. To Brooks & Gilmore, Topeka, 47 crossing plates, ea. $5, and to Hanley & Ritchie, of Iola, 21,372 cu. yd. grading, 22 cts. per cu. yd.; 153,000 cu. yd. overhaul, 1 ct. per cu. yd.; 22,623 sq. yd. brick paving, $1.09½ per sq. yd.; 6 curb catch-basins, ea. $15, and 200 lin. ft. 12-in. vitr. pipe, 90 cts. per lin. ft.

Louisville, Ky.—It is stated that the Bd. of Pub. Wks. will soon let the contracts for paving with asphalt portions of 28th, 26th and 5th Sts., at a probable cost of $37,000.

Leesville, La.—C. K. Oakes, Clk.
Jury, writes that all bids opened on
for grading 30 miles of public roads h
rejected; no date has been set for th
ing of new bids.

Ashland, Ky.—Bids will be receive
by the City Clk. for furnishing mate
constructing brick pavements, concr
and gutter in said city. Approximat
ties: 74,800 sq. yd. brick, on concr
and 34,300 lin. ft. concrete curb an
with necessary catch-basins, etc. C.
gess, City Engr.

Baltimore, Md.—Mayor Timanus i
to have signed the ordinance providin
appropriation of $15,000 for the pav
wood block on a portion of Calvert
with vitrified brick a portion of Lexin

Kalamazoo, Mich.—Bids were op
Feb. 13 for furnishing material an
Lovell St., Kalamazoo Ave. and Rose
work contemplated aggregates abou
sq. yd. paving and 24,000 lin. ft. curb
ter. Bids were received on the vario
of paving as follows:

Brick Pavement—Albert Prange,
$1.736 to $1.82 per sq. yd. according
of brick on city's portion; on street
$2.246 to $2.32; F. M. Kemp & Sons,
town, O., $1.76 to $1.91 (City), $1.81
(St. Ry.); W. W. Hatch & Sons, Gosh
$1.70 to $1.89; Kalamazoo Paving
troit, $1.81 and $1.87; F. A. Fresh
Sons, New Cumberland, W. Va., $1
$1.83 (City), $1.799 to $1.93 (St.
L. Vandehorst, Kalamazoo, $1.72
(City), $1.80 to $1.88 (St. Ry.);
Bros., Detroit, $1.88 to $1.98 (City
and $2.10 (St. Ry.); Michigan Con
Detroit, $1.73 to $1.86 (City), $1.78
(St. Ry.); W. S. Hadley, Canton, O.,
$1.78 (City), $1.72 and $1.74 (St. Ry
land & Clancy, Ann Arbor, $1.81 an
(City), $1.85 and $1.90 (St. Ry.).

Sheet Asphalt—Barber Asphalt
troit, $1.745 and $1.825; Cleveland
Paving Co., Cleveland, O., $1.74 to $

Asphalt Block—Lake Erie Asphalt
ledo, O., $2.22 to $2.37; 3 in., $1.65
$1.80.

Bituminous Macadam—Barber Asph
ing Co., $1.825 and $1.85 (City), $1.
Ry.); Central Bitulithic Paving Co.,
$1.81 to $2.18, and for any brick, $2.

Brick and Block—F. M. Kemp & So
cts. to .84 cts.; W. W. Hatch & So
cts. to .841 cts.; E. A. Freshwater,
to .84 cts.; Carland & Clancy, .85 cts
Stevens, Detroit, .779 to .84; Loga
Mfg. Co., Toledo, .836 cts.; Thomas
Detroit, .79 to .88 cts.; Metropolitan
Block Co., .84 cts.; T. B. Townsend
Constr. Co., Zanesville, .781 cts.

Curb and Gutter, etc.—*a*, Cement c
gutter; *b*, retaining stone set; *c*, re
and resetting ret. stone; *d*, resetting
ing stone; *e*, price for extra excav.;
crete stringer mortar filler: Albert Pr
48 cts.; *d*, 6 cts.; *e*, 37 cts.; *f*, 24 cts.
Kemp & Sons, *a*, 50 cts.; *b*, 30 cts.
cts.; *d*, 10 cts.; *e*, 45 cts.; *f*, 15 cts.
Hatch & Sons, *a*, 50 cts.; *d*, 15 cts.
cts.; *f*, 25 cts. Kalamazoo Paving Co
cts.; *e*, 20 cts.; *f*, 30 cts. E. A. Fres
a, 50 cts.; *c*, 15 cts.; *d*, 10 cts.; *e*,
H. L. Vanderhorst, Kalamazoo, *c*, 30
12 cts.; *e*, 35 cts.; *f*, 29 cts. Lennan
Detroit, *a*, 56 cts.; *b*, 35 cts.; *c* and *d*,
e and *f*, 40 cts. Michigan Contr. Co.,
a, 50 cts.; *b*, 35 cts.; *c* and *d*, 15 cts.
cts.; *f*, 20 cts. W. S. Hadley, *a*, 55
30 cts.; *c*, 10 cts.; *d*, 8 cts.; *e*, 30 cts.
cts. Carland & Clancy, *a*, 60 cts.; *b*,
c, 25 cts.; *d*, 15 cts.; *e*, 50 cts.; *f*, 25 ct
ber Asphalt Co., *a*, 48 cts.; *b*, 40 cts.; *c*,
d, 10 cts.; *e*, 40 cts.; *f*, 21 cts. Clevelan
idad Co., *a*, 55 cts.; *b*, 35 cts.; *c*, 15
20 cts.; *f*, 30 cts. Central Bitulithic
53 cts.; *d*, 10 cts.; *e*, 30 cts.; *f*, 25 cts
Erie Asphalt Co., *a*, 52 cts.; *b*, 25 cts.
cts.; *d*, 6 cts.; *e*, 40 cts.; *f*, 50 cts.
linger Bros., Chicago, Ill., *a*, .425 cts.
& Williams, Freeport, Ill., *a*, .445 cts.
son Constr. Co., Chicago, Ill., *a*, 53 cts.
cts.; *e*, 75 cts. E. W. Seamens, Gran
ids, Mich., *a*, 46 cts. L. T. Bennett, K
zoo, *a*, .445 cts. Roy Williams, Conne
Ind., *a*, 42 cts. and 39⅞ cts.; *c*, 10
5 cts.; *e*, 40 cts.

Duluth, Minn.—Petitions have bee
with the Bd. of Pub. Wks. for the pa
Superior St. from 14th to 24th Ave.
1st St. from 1st Ave. E. to 6th Ave. W.
and specifications have been prepared f
ing 1st Ave. W. with sandstone block
macadam, 2,500 sq. yd.

St. Paul, Minn.—The Assembly is st
have authorized the Bd. of Pub. Wks.
ceive bids for paving portions of Mari
and Rondo St.

St. Paul, Minn.—City Engr. Rund
stated to have estimated the cost of
adamizing portions of Hastings Ave. an
St., at $13,927.

St. Louis, Mo.—Bids will be receive
7 by the Bd. Pub. Improv. for improv
grading, granite curbing, preparing ro
or ground for superstructure, and pavin
asphalt and vitrified brick portions of
ous streets; also for reconstructing a p
of Bartmer Ave. by removing old pav
curbing, preparing road-bed or groun
superstructure and paving with as
Waller Edwards, Secy.

St. Louis, Mo.—The lowest bids recei
the Bd. of Pub. Improvements on Feb.
improving portions of several streets ar
ed to have been as follows: Cabanne, P
Garfield Aves., and Howard St., Wm. R.
Constr. Co., Holland Bldg., $5,617,
$4,342 and $6,094 respectively; As
Wells and Cote Brilliante Aves. Fruin
non, Laclede Bldg., $8,384, $23,551 an
277 respectively.

Nashua, N. H.—Main St. will proba
paved with bituminous macadam, at a c
$15,000. E. J. Johnson, City Engr.

Items marked thus give the names of parties awarded contracts.

W ood, N. J.—J. DuBois, Boro. Clk., hat the following are the bids opened 14 for (a) 125,000 sq. ft. walk, (b) in. ft. curb: Wm. Krause & Son, 1621 St., Philadelphia, Pa., a, 13 cts.; b, B. F. Sweeten & Son, Camden, a, 14 35 cts.; Frank Pidgeon, Saugerties, , 15 cts.; b, 37 cts.; Jas. McLinden, a, a, 14 cts.; b, 32 cts.; Seaboard l Stone Co., Holly Beach, a, 13½ cts.; ts.; Savage Concrete Constr. Co., 136 St., N. Y., a, 13 cts.; b, 30 cts.; Fick- Stobaugh, 56 Pine St., New York, a, s.; b, 33 cts.; Geo. W. Banks, Wild- , 13 cts.; b, 29 cts.; Ogden & Platt on, a, 12¾ cts.; b, 28 cts.; Markland Constr. Co., Land Title Bldg., Phila- Pa., a, 11⅗ cts.; b, 32 cts.; Frank Nunda, N. Y., a, 11¾ cts.; b, 28 cts.; h S. Blome Co., Unity Bldg., Chicago, 10⅕ cts.; b, 26⅖ cts.; C. H. Platt, Holly, a, 12 cts.; b, 25 cts.

El beth, N. J.—Bids are wanted Mar. 15 70 sq. yd. trap block paving on sand tion. W. H. Luster, Jr., City Engr.

ntic City, N. J.—Mayor Stoy is stated e signed the bill providing for the wid- n of the boardwalk to 60 ft. between nd and Illinois Aves., at a cost of).

Th City Council is stated to have passed first reading the ordinance providing paving with asphalt of Atlantic Ave.

ey City, N. J.—Bids will be received Feb. the Bd. St. and Water Comrs., for im- g a portion of Myrtle Ave.; estimate ntities, 1,287 cu. yd. earth excavation, sq. yd. asphalt, 4,272 sq. ft. flagging, sq. ft. relaid and dressed flagging, etc., T. Bouton, Clk.

erson, N. J.—An ordinance has been in- ed in the Bd. of Aldermen, to provide e permanent paving of Bank, Grand, ton, Marshall, River and Union Sts., way, Hamburg Ave., and Lee Place., at proximate cost of $90,000. H. J. Harder, Engr.

Gloversville, N. Y.—Bids will be called for in the spring for about 10,000 sq. yd. asphalt block or bitulithic pavement.

Greensboro, N. C.—See "Water."

Findlay, O.—Plans and estimates are being prepared for three-quarters of a mile of paving on Tiffin Ave.

Toledo, O.—Bids will be received Mar. 2 by the Bd. Pub. Service for furnishing material and improving by paving a portion of School Pl., and repaving a portion of Walbridge Ave., with either various kinds of block, bitulithic pavement or other bitmuinous macadam; also for improving a portion of Woodruff Ave., by grading, constructing necesary retaining walls, drainage, etc. Harry S. Jones, Secy.

Cincinnati, O.—Bids will be received Feb. 27 by the Bd. Pub. Service for furnishing material, grading, curbing and paving with brick a portion of Noble Court. Geo. F. Holmes, Clk.

Bids will be received Mar. 18 by the Bd. Co. Comrs. for improving Compton Road, in Springfield Township, and Eight-Mile Road in Anderson Township. Eugene L. Lewis, Co. Aud.

Cambridge, O.—Bids will be received by the Bd. of Pub. Service on Mar. 14 for grading, draining, curbing, and paving N. 74th St., with brick, asphalt, tar macadam, or bitulithic pavement, as advertised in The Engineering Record.

Bucyrus, O.—Bids will be received Mar. 7 by the Co. Road Comrs. for $25,000 public road improvement bonds. J. I. Smith, Co. Aud.

Philadelphia, Pa.—The following bids are stated to have been received Feb. 17 for (a) paving with asphalt about 20 miles of streets, (b) repaving with asphalt about 4 miles of streets (price given per sq. yd.): Barber Asphalt Paving Co., Land Title Bldg., a, $1.55; b, $1.50. Richardson & Ross Asphalt Paving Co., Betz Bldg., a, $1.82; b, $1.74. Filbert Paving & Constr. Co., a, $2.01; b, $2.04, and W. S. P. Shields, Witherspoon Bldg., b, $2.22.

ew York, N. Y.—The following are the bids opened on Feb. 14 by Louis F. Haffen, Pres. Bronx Boro., for regulating, etc.; (a) P. J. (b) D. W. Moran, 562 Burnside Ave., (c) C. W. Reynolds, (d) Jos. Burns, (e) P. G. Hannan, (f) T. Grogan, (g) G. I. Bailey, (h) M. hy, (i) Vermilye-Garry Con. Co., (j) J. C. Voorhies, (k) Bellew & Merritt Co., (l) C. A. Meyers, (m) P. J. Kane, (n) T. Crimmins Constr.

Heath Ave., from Bailey Ave. to Ft. Independence St.

	a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.
) cu. yd. earth excavation ...	$0.08	$0.80	$0.15	.....	$0.10	$0.50	$0.72	$0.70	$0.50	$0.10	$0.45
) " rock excavation	.60	1.09	1.50	$1.60	1.50	1.60	1.85	2.00	1.50	1.20	1.70
) " fill	.54	...	.40	.50	.45	.25	.10	.20	.25	.43	.36
) lin. ft. new curb	.75	.82	.80	.75	.75	.80	.75	.95	.85	.75	.80
) sq. ft. new flag	.24	.25	.27	.25	.25	.22	.23	.25	.25	.25	.27
) " new bridgestone	.50	.60	.60	.60	.60	.70	.55	.60	.65	.60	.60
0 cu. yd. dry rubble masonry..	1.50	1.58	1.75	2.00	1.50	1.00	1.50	3.00	2.00	3.00	2.00
0 lin. ft. 12-in. vitrified pipe..	.25	...	1.00	...	1.00	.01	...	1.00	.50	1.00	.50
Totals	$37,670	$35,855	$39,964	$43,090	$39,155	$38,535	$38,686	$46,890	$41,157	$39,915	$44,454

E. 133d St., from Southern Boulevard to Cypress Ave.

	b.	l.	m.	a.	h.	i.	f.	n.	k.
4 yds. earth excav..	$1.13	$0.60	$0.65	$0.35	$0.70	$0.80	$0.50	$0.50	$0.45
1 " rock excav..	1.13	1.80	1.60	1.74	2.00	1.75	1.60	1.60	1.60
" fill	...	.30	.01	.01	...	.01	.10	.10	.01
2 " new curb....	.72	.75	.74	.80	.90	.75	.80	.90	.82
ft. new flag	.24	.30	.25	.24	.23	.23	.23	.30	.27
4 " new brdgestn	.50	.65	.65	.60	.50	.60	.60	.60	.62
Totals	$12,413	$13,712	$12,545	$11,763	$14,309	$13,674	$11,889	$12,350	$11,819

New York, N. Y.—The following are the bids opened on Feb. 15 by John F. Ahearn, Pres. hattan Boro., for regulating and repaving with asphalt on present pavement, relaid as dation, 18th St., from Ave. C. to Irving Place; (a) Barber Asphalt Paving Co., 114 Lib- St.; (b) Uvalde Asphalt Paving Co., 1 Broadway; (c) Sicilian Asphalt Paving Co., Times ; (d) Warren-Quinlan Asphalt Co., 32 Broadway:

	a.	b.	c.	d.
220 sq. yd. asphalt pav't, including binder course	$1.52	$1.20	$1.70	$1.75
220 " old stone pav't relaid as foundtn or in approaches, etc.............	.31	.40	.55	.40
640 lin. ft. new bluestone curb	.82	.85	.88	.87
00 " old bluestone curb redresed and reset	.32	.35	.35	.25
44 noiseless covers, complete	15.00	18.00	15.00	15.00
Totals	$28,960	$26,473	$34,557	$33,236

ew York, N.Y.—The following are the bids ned on Feb. 14 by Louis F. Haffen, Pres. nx Boro., for furnishing and delivering en trap rock and screenings; (a) 30,000 d. 1½-in. trap rock stone; (b) 10,000 cu. ½-in. trap rock stone screenings:

	a.	b.	Total.
.. Conklin	$1.62	$1.62	$64,800
wn & Fleming	1.59	1.59	63,600
hattan Trap Rk. Co.	1.64	1.64	65,600
ton Pt. Stone Co...	1.63	1.63	65,200

ew York, N. Y.—The lowest bid opened Feb. 14 by Louis F. Haffen, Pres. Bronx o., for regulating and paving E. 150th St., n Harlem River to River Ave, was that of W. Moran, 562 Burnside Ave., at the fol- ng detail bid: 50 cu. yd. earth excav., cts. per cu. yd.; 3,800 cu. yd. fill, 19 cts.; 30 lin. ft. new curb, 80 cts.; 5,650 sq. ft. flag, 24 cts.; 800 sq. ft. new bridgestone, cts.; 150 cu. yd. dry rubble masonry, $2; lin. ft. vitrified pipe, 75 cts.; for 1 M. ft. ber, $30; and 2,300 sq. yd. granite block 't, $1.84; total, $8,269. The other bidders e Cunningham & Kearns Contr. Co., 438 E. t St., $8,543; M. Fitzgerald, $9,505; rge & Farrell, $9,217; P. J. Kane, $9,322; milye, Garry Contr. Co., $9,118; T. Crim- s Contr. Co., $10,647, and Bellew & Merrit , $10,985.

he lowest bid opened same time and place regulating, etc., Burnside Ave., from Tre- nt Ave. to Ryer Ave., was that of Jos. llo, for $3,497.

Brooklyn, N. Y.—Bids will be received Mar. by Martin W. Littleton, Boro. Pres., for ulating and paving with asphalt, repaving th asphalt, granite and asphalt block por- ns of numerous streets; also for regulating, ading, curbing and laying sidewalks on por- ns of several streets. Engineer's estimate: ,053 sq. yd. asphalt, 23,040 sq. yd. old stone vement, to be relaid; 2,450 sq. yd. asphalt ck, 7,070 sq. yd. granite block, 12,752 cu. concrete, 52,594 lin. ft. new curb., 7,184 yd. earth excav., 48,230 sq. ft. cement lewalk, etc.; bids will also be received on me date for furnishing and delivering 300 yd. paving gravel and 150,000 lbs. paving tch.

Philadelphia, Pa.—See "Business Notes."

Providence, R. I.—The Bd. of Aldermen is stated to have passed a resolution providing for the widening of portions of Crawford and S. Main Sts., at a probable cost of $150,000.

Anderson, S. C.—J. W. Barnett, of Athens, will have charge of paving extensions to be made at Anderson.

**Galveston, Tex.*—W. I. Heffron, of Galveston, has secured the contract for paving 22d St. with vitrified brick, 1,760 sq. yd., for $3,493. W. I. Heffron secured the contract for 600 cu. yd. crushed rock at 65 cts. per cu. yd. f. o. b. at crusher, and $1.59½ per cu. yd. f. o. b. cars at Galveston (bids opened Feb. 15).

San Antonio, Tex.—Bids will be received Feb. 27 by Geo. F. Stuemke, City Clk., for constructing crushed stone pavements, repairing old macadamized or graveled streets, and 60,000 lin. ft. wooden cypress curbing in 4th Ward, Improv. Dist. No. 3. J. D. Rullmann, City Engr.

Seattle, Wash.—The City Council has passed ordinances providing for concrete walks on Eastlake Ave., to cost $7,250, and for an asphalt pavement on 4th Ave. and Pine St., to cost $8,900.

Bids will be received Mar. 4 by C. B. Bagley, Secy. Bd. Pub. Wks., for constructing concrete sidewalks on Brooklyn Ave.; probable cost, $6,750.

**Spokane, Wash.*—The Bd. of Pub. Wks. is stated to have on Feb. 10 awarded contracts for grading, curbing and constructing sidewalks on Bernard and Grand Sts., as follows: Jas. C. Broad, 106 Post St., the former at $3,165, and Jas. C. Kennedy, the latter for $9,000.

Racine, Wis.—City Engr. Connolly is stated to have estimated the cost of paving with brick on State St., at $26,723, and with asphalt, at $32,295.

La Crosse, Wis.—It is reported that bids are wanted Apr. 18 for street work, including 11,206 lin. ft. combination cement curb and gutter, 5,100 sq. ft. concrete driveway, 19,207 sq. yd. macadam, and 5,130 cu. yd. grading. H. J. Beckwith, Chmn.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—Extensive improvements are reported in contemplation by the Birmingham Ry., Light & Power Co. Robt. Jemison, Pres.

Sylacaya, Ala.—Arthur Pew, of Atlanta, Ga., is preparing plans for water works and an electric light plant for which $21,000 bonds have been sold. The water supply will be from springs. There will be about 2 miles of 4 to 8-in. mains. Contracts will probably be let early in March.

San Francisco, Cal.—See "Water."

East Haddam, Conn.—Wm. M. Ransom and F. M. Hoadley, of Providence, R. I., are reported to have purchased the plant of the Salmon River Power Co. at Leesville, and will expend about $300,000 in improvements.

Glastonbury, Conn.—Press reports state that work will begin as soon as weather permits on the construction of a power-house and dam for the Glastonbury Power Co.; probable cost of this work, $175,000. Jas. S. Williams, Pres.; Lewis W. Ripley, Secy., both of Glastonbury.

Washington, D. C.—Bids will be received Mar. 7 at the Bureau of Supplies and Accounts, Navy Dept., Washington, for furnishing at navy yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of arc lamps, incandescent lamps, induction coil, wattmeters, wire, conduit and fittings, electrical supplies, Portland cement, broken stone, sand, vitrified paving blocks, terra-cotta pipe, steam-pipe system, Goubert feed-water heater, injector condenser, motors, wire rope, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Cartersville, Ga.—The City Council is stated to have appointed a committee, with W. H. Milner as chairman, to investigate the question of constructing an electric light plant and a sewerage system.

**Albany, Ga.*—The Albany Power & Mfg. Co. is stated to have awarded to B. H. Hardaway, of Columbus, the contract for constructing a dam and power house at Big Shoals, on Kinchafoonee Creek; contract price reported to be about $100,000.

Savannah, Ga.—The Savannah Lighting Co. is reported to have filed with the Clerk of Superior Court a petition for incorporation; capital, $50,000. The plant will be located on the grounds of the Savannah Lumber Co. Incorporators: John J. Cummings, Lawrence McNeil, J. H. Estill, and others.

Beardstown, Ill.—Dr. Roy H. Garm, and others, are reported to have petitioned City Council for a franchise for a gas-lighting and heating plant which they propose to establish in this city.

South Elgin, Ill.—V. W. Panton, owner of the electric light plant, is reported to have in contemplation some extensions.

Morrison, Ill.—A franchise to establish a $40,000 gas plant is reported to have been granted to Crawford Bros., of Sterling.

Chicago, Ill.—The financial budget is reported to contain an appropriation of $325,000 to provide for the city's electricity by power furnished from the drainage canal.

Stonington, Ill.—L. D. Hewitt is reported interested in the construction of an electric-light plant.

Lockport, Ill.—Stephen D. Griffin, of Chicago, Clk. Bd. of Trus. Sanitary Dist. of Chicago, writes that the following are the bids opened on Feb. 15 for furnishing and installing (a) four 4,000-kw. generators each, (b) two 350-kw. exciters each, (c) totals, to be used for the Lockport power development; Crocker-Wheeler Co., Chicago, a, $22,445; b, $5,793; c, $101,366. National Electric Co., Milwaukee, a, $24,985; b, $3,705; c, $197,350. Westinghouse Electric & Mfg. Co., Pittsburg, a, $26,500; b, $4,250; c, $114,500. The Bullock Electric Mfg. Co., Chicago, a, $26,990; b, $4,557; c, $117,074. National Electric Co., Milwaukee, a, $28,095; b, $3,705; c, $119,790. General Electric Co., Chicago, a, $28,487; b, $4,625; c, $123,200. Stanley Electric Mfg. Co., Chicago, a, $28,825; b, $4,682; c, $124,665.

New Albany, Ind.—The Mayor and Bd. of Aldermen on Feb. 8 are stated to have ratified and declared valid the election for the issue of $20,000 bonds for water works and an electric-light plant.

Muncie, Ind.—The probable cost of work contemplated by the Muncie Gas Light & Fuel Co. (Chas. A. Meeker, Pres.) during this year is $250,000. It is proposed to construct an artificial gas plant, and extend the mains.

Terre Haute, Ind.—The City Council is stated to have passed an ordinance appropriating $1,200 with which to employ an engineer to prepare plans and specifications for a municipal lighting plant.

Bicknell, Ind.—The Co. Comrs. are reported to have granted the Bicknell Light & Power Co. a franchise to light Bicknell.

Noblesville, Ind.—The City Council is stated to have granted G. W. Heinzmann & Co., of Noblesville, a franchise for lighting the city. The company is required to furnish 80 arc lights at $70 per light per yr.

Warsaw, Ind.—The Winona Electric Light & Water Co. is reported to have purchased the water and electric light plant at Warsaw. It is proposed to erect a standpipe 150 ft. high and 18 ft. in diam., and make improvements to the electric light plant.

Hope, Ind.—Geo. S. Cook is reported to have secured a franchise for an electric light plant.

Indianola, Ia.—J. M. Harlan, Pres. Public Water Power & Htg. Co., writes that about $25,000 will be expended in improvements. The company will install Scaife filters, and will purchase pumps.

Red Oak, Ia.—The Red Oak Electric Co. (D. F. McGee, Mgr.) proposes installing two 150-h.p. boilers and one 600-h.p. horizontal engine direct connected to 500-kw. generator.

Waverly, Kan.—Bids are wanted by W. H. Williams, City Clk., for the purchase of $15,000 bonds to be used for water works and an electric-light plant. Engineers, Burns & McDonnell, Kansas City, Mo.; J. C. Fear, Mayor.

Wichita, Kan.—The Merchants' Heating & Lighting Co. is to construct an electric light and heating plant at a cost of $300,000. Engineer W. H. Scott, Marquette Bldg., Chicago, Ill.

Danville, Ky.—The Electric Light Com. of City Council is stated to have received from the National Constr. Co., of St. Louis, Mo., plans and specifications for an electric light plant which it is reported it has the contract to construct in this city. Work will probably begin at once.

Nicholasville, Ky.—It is proposed to purchase one A. C. generator for the municipal plant. C. S. Evans, Mgr.

Mt. Sterling, Ky.—The Mt. Sterling Electric Light & Water Works Co. (O. F. Briggs, Ch. Engr., Mt. Sterling) contemplates purchasing a deep well pump and a 6x4x6 Duplex boiler pump. It is also proposed to overhaul its engine.

Lawrenceburg, Ky.—W. E. Dowling, of the Commercial Club, writes that it is proposed to construct an electric-light plant, at a cost of $12,000.

Abbeville, La.—An election will be held Mar. 28 to vote on issuing $45,000 bonds for water works, a sewerage system and electric-light plant. Engineer, R. C. Huston, of Laurel, Miss. Geo. W. Summers, Secy. of Council.

Portland, Me.—The Consolidated Electric Light Co. of Maine, proposes adding to its plant the following equipment: A 360-kw. 3-phase alternating dynamo, 3 320-kw., 110-volt direct current dynamo, a 1,000-h.p. heater, a 1,500-h.p. condensor and piping. G. E. Raymond, Secy., Portland.

Baltimore, Md.—The United Electric Light & Power Co., and the Wenstrom Electric Co. are reported to have consolidated under the name of the Consolidated Gas, Electric Light & Power Co. Douglas Burnett, Mgr.

Bids will be received Mar. 8 by the Bd. of Awards for furnishing and operating electric arc lamps. Robt. J. McCuen, Supt. Lamps and Lighting.

Salisbury, Md.—The Salisbury Light, Heat & Power Co. is reported to have in contemplation the erection of a boiler house and a thorough rebuilding of its lines this spring. Ralph B. Rhodes, Mgr.

Holyoke, Mass.—It is proposed to add to the municipal electric light plant, a 500-kw. Curtis turbine, and three 250-h.p. boilers. A. W. Darby, Supt.

Lynn, Mass.—It is reported that the Lynn Gas & Electric Co. is about to enlarge its plant by adding a holder with a capacity of 2,000,000 cu. ft. of gas. The company is reported to have applied to the State Gas Comrs. for authority to increase its capital $320,000, for the purpose of meeting the cost of the additional storage capacity, to erect a workshop in the rear of the office on Exchange St., and to meet the cost of underground work and placing wires in conduits.

Salem, Mass.—Fire is reported to have on Feb. 16 damaged the works of the Salem Gas Light Co. to the extent of $27,000.

Cadillac, Mich.—The Cadillac Gas Light Co. is stated to have decided to expend about $15,000 for new gas mains this summer. E. A. Stowe, Pres., Grand Rapids.

Grand Rapids, Mich.—Barney Mayer, Supt. and Ch. Electrician of the municipal electric-light plant is reported to have submitted to Council a report of the cost of placing wires underground. He estimates the cost of laying conduits in concrete and building manholes at $21,645, and for cable, $11,655. For next year's budget he asks for new circuits, $3,000; for a new boiler, $5,500, and for repairs to towers, $400.

**Ludington, Mich.*—The Ludington Gas Co. has awarded to Warren & Pettigrew, of Fox Lake, Wis., the contract for the construction of a gas plant. The plant is to be a water gas plant, and the specifications include the laying of 9 miles of mains. Construction work will commence before May 1.

Bay City, Mich.—Engr. John H. Blomshield has completed the work of survey, taking soundings and preparing the drawings for gas mains to be laid across Saginaw River by the Bay City Gas Co.

Items marked thus give the names of parties awarded contracts.

Pontiac, Mich.—A. Jacobs, of Detroit, a stockholder in the Edison Co., of Detroit, is reported interested in the construction of an electric light or gas plant at Pontiac.

Austin, Minn.—It is proposed to install at the city electric light plant a 300 or 500-kw. alt. generator, with suitable engine or turbine.

Whitebear Lake, Minn.—The Whitebear Lake Electric Co. (E. A. Bacon, Ch. Engr.) will construct an underground system at Manitou Island, a distance of 1 mile.

**International Falls, Minn.*—Press reports state that the Koochiching Power Co., which is about to develop the water power at International Falls, has awarded to the Alpena Portland Cement Co. the contract for the cement to be used in the construction of the dam, paper and pulp mill. Amount of contract reported to be $100,000.

Pass Christian, Miss.—The Town Council is stated to have passed an ordinance inviting bids to light the town with electricity.

Harlem, Mo.—W. Henry, of the Henry Light, Power & Mfg. Co., writes that about $5,000 will be expended in improvements bids for which will be opened on Mar. 1.

Jefferson Barracks, Mo.—Bids are wanted Mar. 17 for installing exterior and interior electric-light system here. Address Maj. Thos. Cruse, Depot Q. M., St. Louis.

**St. Louis, Mo.*—The Union Electric Light & Power Co. is reported to have awarded to the National Electric Co., of Milwaukee, Wis., the contract for electric machinery, for about $175,000.

**St. Louis, Mo.*—The Bd. of Pub. Improv. is stated to have on Feb. 14 awarded the contract for lighting the city south of Keokuk St. to the Welsbach St. Lighting Co. of America, for a period expiring Aug. 31, 1910. The contract is at the rate of $5.95 per lamp per 1,000 lamp hours, or $24.44 per lamp per yr., a total cost of $40,663 per yr. Other bids were as follows: American Lighting Co., of Baltimore, Md., $6.19 per lamp per 1,000 lamp hours, or $42,272 per yr.; Cleveland Street Lighting Co., $6.38¾ per lamp per 1,000 lamp hours, or $43,621.25 per yr. The lighting department divides the year into 4,109 lamp hours, or a total of 6,829,158 hours for the 1662 mantle lamps to be used south of Keokuk St.

Sturgeon, Mo.—W. A. Seymour, City Clk., writes that the citizens voted Feb. 6 to issue $5,000 bonds for an electric-light plant.

Portsmouth, N. H.—Bids will be received Mar. 25 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for furnishing in place a 20-ton electric traveling crane at navy yard here. Estimated cost, $5,000.

Wells, Nev.—The Elks Electric Light & Power Co. is reported incorporated, with a capital of $100,000, by A. W. Hesson, John J. Hylton, C. J. Hood, and others.

Watkins, N. Y.—The Village Trus. are reported to have selected an engineer to prepare plans for an electric-light plant.

Ilion, N. Y.—Governor Higgins has signed the bill legalizing an issue of $25,000 bonds for an electric light plant for Ilion.

Salisbury, N. C.—The Salisbury & Spencer Ry. Co. is reported to have sold an interest in its system to the American Gas & Electric Co., of Providence, R. I., and it is stated that the line now under construction between Salisbury and Spencer will be completed and put into operation, and an electric-light system will be installed at Spencer.

Newark, O.—Bids will be received by the Bd. of Pub. Service (T. P. Kellogg, Clk.), Mar. 21, for furnishing for a period of 10 years a system of electric lamps or of gas lamps, or a combination of them, as advertised in The Engineering Record.

Niles, O.—The City Light & Water Wks. (Bert. Holloway, Mgr.) contemplate changing its street lighting from d.-c. open to a.-c. enclosed; also to install either a 300-kw. turbine or direct-connected engine and generator and a new feed-water heater.

Bellefontaine, O.—This city expects to rebuild this summer its entire municipal plant with a bond issue of $50,000. C. W. Buchanan, Mgr.

**Newburg, O.*—Dr. A. B. Howard, of Cleveland, Supt. Newburg State Hospital, writes that the Skinner Engine Co., of Erie, Pa., has secured the contract for an engine, and the Akron Electric Co., of Akron, O., for the dynamo and switchboard, for the Newburg State Hospital; total cost of work, $4,640.

Guthrie, Okla. Ter.—W. E. Culp, of Cleveland, Okla. Ter., representative of Benedum & Trees, of Pittsburg, Pa., natural gas operators, is reported to have petitioned City Council for a 21-yr. franchise to pipe natural gas to this city. This company is reported to have secured a franchise in Oklahoma City. The cost of the pipe line from Cleveland to Guthrie and Oklahoma City will be about $1,500,000, according to the report.

Linfield, Pa.—The Linfield Electric Light Co. is reported incorporated, with a capital of $5,000, to supply light, heat and power by electricity in Limerick Township. Directors: Horace Ashenfelter, Royersford; G. E. Brownback, Linfield, and others.

Turtle Creek, Pa.—The Rose Electric Light & Power Co., of Turtle Creek, is reported organized, with a capital of $20,000, to erect a power plant to supply Turtle Creek and adjoining boroughs with light and power. Wm. L. Ledger, Pres.

Mt. Union, Pa.—Scott Dibert, Pres. Mt. Union Silica Brick Co., is reported to have secured a franchise for the construction of an electric light plant to light the brick works and the town.

Brownsville, Pa.—The Brownsville Light, Heat & Power Co. proposes installing a 250-h.p. engine and a 200-kw. generator. J. M. Bell, Mgr.

Catasauqua, Pa.—Among the improvements contemplated to the Lehigh-Northampton Gas & Electric Co., which is now in the hands of a receiver, are the following: One 300-h.p. boiler, one 250-kw. and one 150-kw. condensing engine, one condenser, one feedwater heater, one feed pump, one oil operator, two water generators, one 250-kw. D. C., the other 150-kw. D. C., switch boards and to change lines in Catasauqua, Coplay and Alliance.

Marion, S. D.—The Town Council is reported to be considering a proposition submitted by J. A. Heeron & Co., for the construction of water works and an electric-light plant.

Pulaski, Tenn.—It is proposed to purchase a larger engine and dynamo for the municipal electric light plant. C. H. Brown, Supt.

Nashville, Tenn.—Bids will be received Feb. 28 at the Treas. Dept., Washington, D. C. (H. A. Taylor, Acting Secy.), for furnishing and installing certain combination gas and electric-light fixtures in U. S. Custom House here. The City Council has passed on second reading an ordinance appropriating $12,600 for purchasing a generating unit and $2,500 for purchasing an arc lamp transformer.

Farmville, Va.—This town is in the market for one 250-h.p. engine, 1,200-kw. A. C. generator, 35 C. C. enclosed arc lamps, switchboard, etc., for its municipal electric plant. H. K. Bullock, Supt.

Cape Charles, Va.—It is reported that bids will be received about Mar. 6, by the Town Council, for an electric lighting franchise.

Fredericksburg, Va.—This city expects to add to the municipal plant next year an incandescent and power circuit. Will use 3-phase, 60 cycles. E. M. Greene, Mgr.

Cape Charles, Va.—Bids are wanted Apr. 3 for an electric-lighting franchise, as advertised in The Engineering Record.

Colonial Beach, Va.—The Colonial Beach Electric Light & Power Co. is reported to have secured a franchise for an electric-light plant.

South Bend, Wash.—The City Council is reported to have granted J. M. Etnier a franchise for furnishing electric-light and power.

Seattle, Wash.—The American Improv. Co. is reported to have applied for a gas franchise.

Everett, Wash.—Improvements to the amount of $25,000 are reported contemplated to the plant of the Everett Gas Co. Several miles of new mains will be laid.

Snohomish, Wash.—The Snohomish Electric Light & Water Power Co. (C. Cleaver, Ch. Engr.) proposes extending its system to Machias and out in rural districts.

Tacoma, Wash.—The City Council has passed an ordinance granting a power franchise to the Tacoma Ry. & Power Co. This franchise gives the company the right to supply electric current to manufacturers and users of power off its street railway lines.

Spokane, Wash.—Press reports state that the Washington Water Power Co. (D. L. Huntington, Mgr., Spokane) will soon increase its capital to $5,000,000, to cover the expenses of extensions and improvements. In addition to the Post Falls, Idaho, power plant contract, which has been let to Nelson Bennett, of Tacoma, it is proposed to extend the line to Medical Lake, at a cost of about $300,000, and also build between 2 and 3 miles of extension within the city limits.

Minocqua, Wis.—John Woodloch, of Merrill, owner of the electric light plant at Minocqua, is reported to have in contemplation the rebuilding of the plant next summer, to include new dam, new water wheels, new dynamo and a new line 5 miles in length.

Sturgeon Bay, Wis.—This city expects within a year or two to rebuild its municipal electric light plant. Jas. E. Johnson, Mgr.

Cumberland, Wis.—The Council is reported to be considering the establishment of an electric-light plant.

Lander, Wyo.—Press reports state that the Clarisse Gold Mining Co. will construct a power plant, to cost about $80,000, at the site of the great oil wells owned by the Belgo-American Co. near Lander. The power will be transmitted a distance of about 28 miles to the mines of the company at South Pass.

Toronto, Ont.—The Ontario & Minnesota Power Co. is reported incorporated, with a capital of $3,000,000, by W. E. Backus, of Minneapolis, Minn.; R. A. Grant, an attorney, of Toronto, and others, to purchase, maintain and develop water and other power, and construct or acquire works and appliances for the transmission of electricity. Principal office to be at Toronto.

St. Thomas, Ont.—Bonds to the amount of $200,000 are reported sold, to be used for the purchase of the gas and electric-light plant.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

San Jose, Cal.—The City Council is reported to have granted a franchise to the San Jose & Los Gatos R. R. Co., for a single-track electric railroad on Park Ave., completing the loop of that company's line to Saratoga, Congress Springs and Los Gatos, by forming the link with the Campbell Short Line between the latter town and San Jose.

Oroville, Cal.—A. E. Boynton has applied for a franchise to construct an electric railway in Butte County, and bids for said franchise will be received Mar. 10 by H. T. Batchelder, Clk. Bd. Supervs.

Bakersfield, Cal.—The Bakersfield & Kern Electric Ry. Co. has applied for a 50-year street railway franchise, and bids for said franchise will be received Mar. 13 by A. T. Lightner, Clk. Bd. Trus.

Los Angeles, Cal.—The Los Angeles-Pacific R. R. Co. is reported to be planning improvements to its entire system for the near future. The service at Santa Monica is to be still further improved at once, and the present freight depot there is to be replaced with a structure to be used for both freight and passenger purposes. The erection of a station depot at Linda Vista Park, on Ocean Ave., is also planned. The shortening of the route to Los Angeles via Sawtelle is contemplated. This plan will involve the building of many miles of new double track. Playa del Rey cars are to be run through Santa Monica hereafter, instead of running to Los Angeles via Ocean Park.

Stockton, Cal—Plans are reported to be perfected for rebuilding the Stockton Electric Railroad, operating 12 miles of line. In all, $300,000 will be expended upon this work. The improvement will extend to all parts of the system. New rails will be laid, and the gage of the track changed from 3 ft. 6 in. to 5 ft. New cars will also be put into service. Henry H. Lynch is in charge of the new work.

Rockford, Ill.—The Rockford Belt Ry. Co., principal office Chicago, has been incorporated, with a capital of $100,000, to construct a belt railway in Rockford. Wm. F. McSwiney, Frank M. Clark, Benj. H. Harris, all of Chicago, and John C. Duffin, of DeKalb, are reported interested.

Huntington, Ind.—The electors of Clear Creek Township, Huntington County, are reported to have voted a $5,000 subsidy in aid of the Huntington, Columbia City & Northwestern Traction Co., which proposes to build a line from Huntington to Goshen. Several other townships will vote on the subsidy proposition for this road in a short time.

Marion, Ind.—The Bd. of Comrs. has granted a franchise to the Geneva Traction Co. to build an electric railway east from Marion through Grant County. The company will build through Blackford County and to Celina, O. A. G. Briggs, Secy.

Grinnell, Ia.—The Grinnell Interurban Ry. Co. has been organized by J. P. Lyman, O. K. Cole and R. M. Haines, to do the preliminary work of getting right of way and franchises, making surveys, etc., such as are necessary before financing the project and building the road; capital, $10,000.

Boston, Mass.—Several propositions bearing on the question of changing the proposed Cambridge Rapid Transit system from an elevated structure, as provided by law, to a subway, are reported to have been submitted to the Boston Elevated Ry. Co., by the City Council Committee on Rapid Transit.

*Hugh Nawn Contracting Co., 82 Savin St., has secured the contract for constructing the Washington St. tunnel, Sect. No. 4 (bids opened by the Boston Transit Comn. on Feb. 14), for $466,482.

Adrian, Mich.—J. W. Helme and W. H. Hand, of this city, are reported to be working on the Adrian and Jackson proposed electric road, and have secured practically all of the right of way franchises except in this city, where the route has not yet been decided upon.

Minneapolis, Minn.—It is understood the Twin City Rapid Transit Co. is arranging for a right of way from Hopkins to Excelsior, preparatory to extending to Lake Minnetonka the coming summer.

Excelsior, Minn.—The City Council has granted a franchise in that village to an interurban railway company which proposes to build a line to Minneapolis. E. J. Phelps and F. E. Kenaston are the promoters of the enterprise.

Syracuse, N. Y.—The State Board of Railroad Comrs. is reported to be considering granting the Syracuse & South Bay Railroad Co. a certificate to construct a 10-mile double-track electric railway between Syracuse and South Bay on Oneida Lake.

*The Rochester, Syracuse & Eastern Railroad Co., which is building an 80-mile double-track electric railway between Rochester and Syracuse, N. Y., has just let contracts which call for the completion of the first 36 miles of the road, from Rochester to Clyde, by the middle of November of this year. The two latest contracts are those to J. G. White & Co., of New York, for the laying of track, and to J. M. & C. G. Buckley, of Worcester, Mass., for the construction of the power house at Lyons, the latter to be completed by July 1. Contracts for the grading of the line are being filled by the John Shields Construction Company, of New York; Fred T. Ley & Company, of Springfield, Mass., and J. G. White & Company, of New York. The Westinghouse Electric & Mfg. Co. has the contract for the electrical equipment of the power house, substations and rolling stock.

New York, N. Y.—The New York & New Jersey Bridge Co. is stated to have made application to the Sinking Fund Comn. for the confirmation of a freight approach from the Battery to 59th St., to a bridge which the company has been authorized to build between New York and New Jersey. It is proposed to build the approach on the West Side on a marginal street west of West St. Jas. S. Clarkson, surveyor of the port of New York, is president of the New York & New Jersey Bridge Co.

Auburn, N. Y.—The State Board
road Comrs. is reported to be consid
application of the Auburn & Northe
for a certificate of public conveni
necessity to construct an 8-mile ele
way from Auburn to Port Byron.
is projected by interests affiliated
Auburn & Syracuse Electric and th
ter, Syracuse & Eastern, which it
nect.

Oxford, N. Y.—Application is re
have been made to the Trus. of th
by H. C. Stratton and H. D. Strat
senting the Chenango Co., for a fr
build an electric railway along th
the abandoned Chenango Canal.

Wooster, O.—Col. C. V. Hard, of
is reported interested in the constr
the Cleveland, Ashland & Mansfield
road was projected several years ag
southern extension of the Cleveland
western Traction Company's system
Abbott, of the Roberts & Abbott Co.
land, is reported to be doing the p
work. The road will connect with
land & Southwestern at Wellington

Coshocton, O.—The Zanesvill, Co
New Philadelphia Traction Co., of
has been incorporated by John W
ham, Wilber F. Stanley, Geo. C. H
C. Ferguson and others, to build a
railway from Zanesville to New Ph
by way of Coshocton.

Lorain, O.—The Lorain St. Ry
applied to the city for a franchis
it to extend its lines on 10th and

North Amherst, O.—H. E. Ada
Baker, of this place, are reported t
ing to secure an electric railway f
Amherst to South Amherst, a dist
miles. They are trying to induce
land & Southwestern Traction Co
the line, and if this cannot be done
organize a company to build the li

Cincinnati, O.—J. G. Schmidlapp
the Cincinnati Rapid Transit Rai
which plans to build an elevated
the city. The motive power will be
applied by the third-rail system;
be one station at the western ter
near 3d and Walnut Sts., and one n
Pike Sts.

Columbus, O.—It is reported
Columbus Ry. & Light Co. will ma
ber of improvements this year, the
portant being the installation o
storage-battery station as reserve

New Lexington, O.—Edw. S.
New Straitsville, is reported to
pleted arrangements for the financ
Perry Electric Ry., Light & Power
proposes to build an electric rai
New Straitsville to Zanesville by w
Lexington. Bonds to the amount
000 will be placed on the proposit
said that work will start as sc
weather permits.

Fairview, Ore.—Right of way h
cured for an extension of the Ore
Power & Ry. from Cedarville, thr
view and Troutdale. A. L. Stine,
view Civic Improvement Club, is in

Jersey Shore, Pa.—The Jersey
Ry. Co. proposes installing a 225-h
outfit. G. W. Nice, Supt. Jersey

Shenango, Pa.—The Shenango T
has been granted a right of wa
Middlesex Council. Wheatland,
and Greenville have also granted
and when Sharon Council takes
action the company will have a cl
way from Cambridge Springs to
The road will cost $1,500,000.

Scranton, Pa.—An electric railw
from Providence Square up thr
chilla, Glenburn and Dalton, is
contemplation. Former Mayor W
is said to be at the head of the pr

Stroudsburg, Pa.—It is report
asking for franchise from the
Town Council, Chas. H. Latta, of
Mgr. and Treas. of the Stroudsbu
ampton Electric Ry., declared th
pany is now ready to push the wo
his road would be equipped with
phase system.

Harrisburg, Pa.—Among the ch
ed at the State Department recen
following: Rohrerstown, Landisvil
Joy Electric Ry. Co., capital $60,0
10 miles of line from Rohrerst
Joy. Chas. K. Keller, Pres., Lam
The Waynesburg St. Ry. Co., capi
to build 2 miles of line from Wa
Morrisville. W. R. Scott, Pres.,

York, Pa.—Two resolutions were
Recorder's office, Feb. 16, settin
intentions of the York Intramural
the York & Electric Co., to build
tensions of their proposed syste
city. The routes cover the sect
northeast, east and southeast of t
bracing a distance of about 4 mi
tion to the routes already propose

Charleston, S. C.—The Charles
merville Electric Ry. Co. has
charter. Ogden Edwards, of Tro
E. P. Guerard, of Charleston, Sec
pany is capitalized at $100,00
privilege of increasing its capit
$1,000,000. Gen. A. J. Warner,
ville, Ga., will finance the buil
road. Work of actual constructio
as soon as all rights of way betw
ton and Summerville have been s

Watertown, S. D.—The Water
portation Co. has secured a fran
street railway, steam or electri
Lake Kampeska.

Items marked thus give the names of parties awarded contracts.

arksville, Tenn.—The Clarksville Electric Ry. Co. has filed an amendment to its ter changing its name to the Clarksville & Light Co., and increasing its stock 1 $20,000 to $250,000. The amendment iorizes the extension of the lines to the tucky State line, New Providence, Dubars e, etc.

airmont, W. Va.—The Fairmont & Clarks- Traction Co. will construct about 20 es of line connecting Fairmont and rksburg. A. L. Linn, Jr., Mgr., Fairmont.

Vheeling, W. Va.—Surveys are reported as ıg made in the interest of the proposed tric railway between Wheeling and Can- . Edw. Hobson, of Flushing, is reported erested.

Iamilton, Ont.—The Finance and Works nmittees of City Council are stated to have ided to grant the application of the Hamn, Ancaster & Brantford Electric Ry. Co. an independent entrance into the city, l the route proposed by the company—Main l Hess Sts.—was adopted.

RAILROADS.

Notes Arranged Alphabetically by States.

Morris, Ill.—The Morris Terminal R. R. ., of Chicago, has been incorporated, with capital of $50,000, to construct a belt railad in Morris, Ill. Incorporators: C. E. ook and Oscar Haeberle, Ottawa, Ill.; C. Gardner, Mendota, and others.

Council Bluffs, Ia.—The city and railroad ficials are reported to be considering the ising of 42 railroad bridges spanning Indian eek. S. L. Etnyre, City Engr.

New Orleans, La.—Press reports state that ıe 'Frisco R. R. Co. (J. F. Henckley, Ch. ngr., St. Louis, Mo.) will construct a new ne west of the Mississippi River into New rleans.

Detroit, Mich.—W. H. Newman, of New ork, N. Y., Pres. Michigan Central R. R., rites that matter of constructing a tunnel nder Detroit River is being considered by ıis company. Investigations are being made find out approximate cost of handling trafc through it, and the rights that can be obained for its construction.

**New York, N. Y.*—The New York, New Haven & Hartford R. R. Co. is reported to ıave awarded to the New York Contracting Trucking Co., 521 E. 17th St., the contract or the proposed six-track improvement of the oad from this city to New Rochelle, for about 6,000,000.

Toledo, O.—The Baltimore & Ohio R. R. Co. D. D. Carothers, Ch. Engr., Baltimore, Md.) s reported to have decided to construct a ranch road from a point on its line near Fostoria to Toledo. Large terminals will be uilt at Toledo, and several grain elevators will be erected, according to the report.

Cleveland, O.—Local press reports state hat at a meeting between the Pennsylvania R. R. and the city officials on Feb. 9, a working engineers' agreement, covering all of the 32 Pennsylvania crossings in the city and an agreement providing for the commencement of actual work of abolishing those in the Newburg section of the city, was drawn up and signed. The distance of trackage involved is 7,000 ft., and the cost of the work named in the ordinance is $825,000, of which the city's share is to be $234,000. The work of separating the grades at all these crossings must be completed in two years from the date of the passage of the measure. W. C. Carter, City Engr.; W. H. Brown, Ch. Engr. Pennsylvania R. R., Philadelphia, Pa.

Carrolltown, Pa.—The New York Central R. R. Co. is reported to have commenced surveying for a new railroad through the northern part of Cambria County. It will start at Carrolltown, 10 miles, and extend northward and then to Ehrenfeld and Wilmore. Henning Fernstrom, Ch. Engr., New York, N. Y.

Scranton, Pa.—It is stated that the Scranton, Factoryville & Tunkhannock R. R. Co. is to construct a railroad from Scranton to Tunkhannock. J. Selden Swisher, Jas. P. Dickson, and Chas. D. Sanderson, of Scranton, are reported interested.

Washington, Pa.—A corps of surveyors for the Leckrone & Little Whiteley Creek R. R. is reported to be at work from the mouth of the Little Whiteley Creek, Greene County, to Waynesburg. The proposed line is 15 miles long, and it will connect with the Waynesburg & Washington R. R. Co., which extends from Waynesburg to Washington.

**South Fork, Pa.*—The Eng. Dept. of the Pennsylvania R. R. is stated to have awarded the contract to Chas. A. Sims & Co., of Philadelphia, for the construction of a jump-over at South Fork, for about $120,000. The jump-over will enable west-bound trains on the main line to pass over to the Windber branch, which joins the main line at South Fork, without crossing the east-bound track at grade. The contract calls for 3,000 yd. masonry work for retaining walls, and for between 80 and 100 yd. of excavation. L. R. Zollinger, Asst. Engr., with headquarters at Altoona, has charge of the work.

Wise, Va.—Eastern capitalists are reported to have purchased the Virginia & Kentucky R. R., and will extend the line via Pound Gap into the Elkhorn coal fields. A short tunnel will be necessary at Pound Gap.

North Yakima, Wash.—The Northern Pacific Ry. Co. (E. J. Pearson, Ch. Engr., St. Paul, Minn.), is reported to have decided on improvements in the yards here to cost about $150,000.

Milwaukee, Wis.—The Milwaukee and State Line Ry. Co., of Milwaukee, has been organized to construct and maintain 34 miles of road through Milwaukee, Racine, and Kenosha Counties; capital, $10,000. Incorporators: Chas. L. Lowe, Clarence B. Hale, and John M. Mariga, all of Chicago, Ill.

Portage, Wis.—The Wisconsin Central R. R. Co. (C. N. Kalk, Ch. Engr., Milwaukee) is reported to have completed the survey for an extension from its Portage branch to Lake Ennis.

Big Horn, Wyo.—The Big Horn Ry. Co. has been incorporated, by Geo. W. Holdredge, of Omaha, Neb., Gen. Mgr. of the Burlington; W. P. Durkee, Auditor, Omaha, Neb., and others, with a capital of $5,000,000. The Big Horn Ry. is a branch of the Burlington R. R., planned to run through Big Horn and Fremont Counties, Wyo. This branch will extend south from the Burlington's lines in northern Wyoming into the Shoshone Indian reservation.

Winnipeg, Man.—R. H. Flaherty and H. E. Knobel, Port Arthur, Ont., and G. A. Elliott, of Winnipeg, are reported to be seeking incorporation of the Labonk & Thunder Bay Ry. Co. The projected line is to run from Thunder Bay, following the Blende River to Labonk Mine, in the Township of MacTavish, thence to Loon Lake.

Toronto, Ont.—The Canadian Pacific R. R. Co. (W. F. Tye, Ch. Engr., Montreal) is reported to have appointed J. W. Leonard, with offices at Toronto, as manager of construction of the railway between Sudbury and Toronto.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—It is reported that the Co. Comrs. are about to offer for sale $200,000 bonds issued for the purpose of erecting a new jail, and making improvements to the county court house and asylum.

Cullman, Ala.—The Co. Comrs., it is reported, have engaged W. S. Hull, of Jackson, Miss., to prepare plans for the jail and extensions to the county court house.

Phoenix, Ariz.—Plans have been called for from Phoenix architects for a library, for which Andrew Carnegie has given this city $25,000.

San Francisco, Cal.—Bids are wanted Mar. 8 for constructing keepers' dwelling, fog signal house, with machinery, etc., at Piedras Blancas Light Station. Lieut.-Col. Thos. H. Handbury, Corps Engrs., U. S. A.

Denver, Colo.—It is reported that the erection of a new city hall, at a cost of about $1,000,000, is under consideration.

Greenwich, Conn.—It is reported that a general hospital to cost $100,000 is to be erected on Millbank Ave. Address Robt. M. Bruce.

**Norwich, Conn.*—It is stated that Simpson Bros., 166 Devonshire St., Boston, Mass., have received the contract to erect the powerhouse at the Hospital for the Insane, at a cost of about $40,000, and the Eastern Expanded Metal Co., Tremont St., Boston, the contract for the floors and fireproofing of the main building, Lehigh Portland cement to be used throughout. Both contracts, it is stated, are conditional upon the appropriations for the buildings being made by the legislature.

Washington, D. C.—The U. S. Senate has adopted a bill increasing the appropriation for the municipal building from $2,000,000 to $2,500,000.

Macon, Ga.—Bids will be received Apr. 3 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for enlarging (except elevator, heating apparatus, conduits and wiring) U. S. Post Office, etc., here.

Dublin, Ga.—Bids will be received Mar. 7 by the Bd. Co. Comrs. for remodeling county jail. Albert R. Aman, Chmn.

Chicago, Ill.—A building committee, consisting of Chas. L. Hutchinson, W. J. Watson and C. L. Raymond, it is stated, has been appointed to arrange preliminary matters for the erection of a new $200,000 edifice on the present site of the Old People's Home, 39th St. and Indiana Ave.

The financial budget is reported to contain appropriations as follows: $60,000 for a new section for women at the House of Correction and a wall around the Isolation Hospital; $75,000 for public baths, to be established by the Health Department, and $235,000 for the Harrison St. police station.

Kentland, Ind.—It is stated that bids will be received until Apr. 3 by the Co. Comrs. for erecting a court house, including plumbing and heating. Alonzo G. Purkey, Co. Aud.; Jos. T. Hutton, Archt., Hammond, Ind.

**Ft. Des Moines, Ia.*—Contracts have been awarded by Capt. L. Hardemen, Q. M., U. S. A., for work at this post (bids opened Jan. 19) as follows: To L. H. Kurtz, 312 Walnut St., Des Moines, for plumbing, $19,413; to E. J. McDonough & Co., for steam-heating, $12,807, and to T. H. Rattenbury, 409 Citizens' National Bank Bldg., Des Moines, for electric wiring, $3,575.

Oskaloosa, Ia.—Bids will be received until Mar. 13 by S. R. Crissy, City Clk., for erecting a city hall and fire department building combined. Probable cost $40,000. Bids are to include plumbing, gas and electric fixtures. F. E. Wetherell, of Oskaloosa, is the archt.

New Orleans, La.—Local press reports state that the Court House Comn. is receiving plans until June 15 for the new court house. Bernard McCloskey, Pres.

Portland, Me.—Plans submitted by Guy Lowell and Geo. Burnham, Assoc. Archts. of Boston, Mass., for the new court-house, it is reported, have been accepted. The building is to be of granite, and is to be erected on Federal St.

Baltimore, Md.—The Pub. Improv. Com. (Francis K. Carey, Chmn.), it is stated, has adopted a report favoring the erection of a new Central Police Station, the cost of the building and ground to be about $200,000.

The Centre Market Comn. Feb. 16 adopted plans for the wholesale produce market as submitted by Simonson & Pietsch, of Baltimore. The building is to be 2 stories high, constructed of brick, stone, steel and concrete, and is to cost about $120,000.

The Comn. has directed the same archts. to complete the specifications for the fish market building, so as to receive bids for its construction as soon as possible. This building is to cost about $100,000. Gen. Felix Agnus is Chmn. of Comn.

Brockton, Mass.—The City Council has adopted the ordinance appropriating $30,000 for the erection of an armory.

Walker, Minn.—The State Bd. of Control and the Advisory Com., it is stated, are about to petition the legislature for an appropriation of $100,000 for the erection of a sanitorium for consumptives near Walker. The appropriation to become available so as to begin the construction in the spring.

Williamsburg, Miss.—It is stated that the Bd. of Superv. of Covington County are receiving plans and specifications for a court house to cost about $25,000, to be erected here to take the place of the structure which was recently destroyed by fire.

Monticello, Miss.—Plans and specifications will be received March 6 by the Bd. Co. Supervs. for erecting a 2-story jail, steel cells above and below, cost not to exceed $10,000. W. H. Speights, Clk.

St. Louis, Mo.—Plans prepared by J. L. Wees, 520 Olive St., have been accepted for the Evangelical Deaconess' Hospital which is to be erected on Bell Ave. and Sarah St., and is to cost about $100,000. The Bldg. Com. is composed of Rev. J. F. Klick (Pres.), G. H. Watterau, Rev. Kelmme and Rev. F. P. Jens.

Springfield, Mo.—Reed & Heckenlively, 302 College St., is is stated, are preparing plans for the 3-story brick building which is to be erected at Nicholas and Mian Sts., for the St. John's Hospital. Probable cost, $25,000.

Jersey City, N. J.—Bids will be received Mar. 2 by the Bd. Chosen Freeholders for $65,000 new county building bonds. John P. Egan, Clk.

Binghamton, N. Y.—The following are the bids opened on Feb. 14, by the State Armory Comn., at Albany, for a State Armory at Binghamton:

*Construction: Matthias Stipp, Binghamton, $86,736 (awarded contract); Hudson Valley Constr. Co., Troy, $90,700; Dean & Havens, Olean, $91,627; Scott & Robb, Norwich, $93,484; Nay, Aug., Lumber Co., Scranton, Pa., $93,618; The Fosburgh Co., Boston, Mass., $94,000; S. H. Carrington, Binghamton, $95,733; Dewitt A. Hayes, Gloversville, $96,000; P. Keeler Bldg. Co., Albany, $96,193; Morris Kantrowitz, Albany, $97,500; John Dyer, Jr., Albany, $99,920, and A. J. Robinson Co., New York, $115,935.

*Structural Steel and Iron Work: Matthias Stipp, Binghamton, $10,800; Nay, Aug., Lumber Co., Scranton, Pa., $11,760; S. H. Carrington, Binghamton, $12,432; P. Keeler Bldg. Co., Albany, $13,300; A. J. Robinson Co., New York, $15,675; American Bridge Co., New York, $10,445 (awarded contract); Lewis F. Shoemaker & Co., Philadelphia, Pa., $10,871; Rochester Bridge & Constr. Co., Montour Falls, $10,737; Belmont Iron Works, Philadelphia, Pa., $11,113; West Side Structural Co., Troy, $13,495, and Canton Bridge Co., Albany, $13,856.

(*a*) Heating, (*b*) *Plumbing: J. S. Goodenow, Utica, *a*, $5,417; Gaylord & Eitapenc Co., Binghamton, *a*, $6,682; Breen Bros., Utica, *a*, $6,963; *b*, $7,963. Cleghorn Co., Boston, Mass., *a*, $7,000; Shapley & Wells, Binghamton, *a*, $7,558; Burleson Hardware Co., Susp. Bridge, *a*, $7,940; *b*, $6,940. Richard T. Ford, Rochester, *a*, $7,987; *b*, $4,800. John L. Fitzgerald, Albany, *a*, $8,200; *b*, $6,270. Wm. H. Tobin, Syracuse, *a*, $8.200; *b*, $7,999. Edward P. Bates, Albany, *a*, $8,500; Runyon & Ogden, Binghamton, *a*, $8,744; Cacacriqui, Buffalo, *a*, $8,793; McDonald & Drummond Co., Rochester, *a*, $8,795; Edw. Joy, Syracuse, *a*, $9,445; *b*, $6,200 (awarded contract); Cornelius Dwyer, Amsterdam, *a*, $10,525; *b*, $9,252; Hean & Havens, Olean, *b*, $6,698.

Electric Light Wiring and Fixtures: John P. Kelly, Schenectady, $6,630; Commercial Constr. Co., N. Y. City, $6,747; G. & E. Electrical & Constr. Co., Binghamton, $7,000; John C. Buchenau, Syracuse, $7,356; John F. Buchanan & Co., Philadelphia, Pa., $7,495; Frost & Sheldon, Albany, $7,840; Standard Electric Constr. Co., Rochester, $8,100.

**Brooklyn, N. Y.*—The contract to erect the Prospect Park branch of the Carnegie Library, it is reported, has been awarded to the Church Constr. Co., 126 Liberty St., N. Y., City, at about $93,000. It is to be located at 6th Ave. and 9th St.

Syracuse, N. Y.—The Bd. of Directors of the Syracuse Hospital for Women and Children, it is stated, has decided to spend $40,000 in the erection of a building east of the hospital for the temporary use of nurses and private patients.

Flushing, L. I., N. Y.—The following are the bids opened on Feb. 7, by the State Bd. of Armory Comrs., for an armory at Flushing:

Construction: (*a*) amount, (*b*) to deduct if gallery in drill hall is omitted, (*c*) deduct if concrete in basement is omitted: Morris Kantrowitz, Albany, *a*, $62,777; *b*, $600; *c*, $700. Hudson Valley Constr. Co., Troy, *a*, $62,900; *b*, $1,000; *c*, $1,500. Peter Keeler Bldg. Co., Albany, *a*, $70,784; *b*, $881; *c*, $1,061. J. Ames MacArthur, Brooklyn, *a*, $85,167; *b*, $630; *c*, $1,100. George Hildebrand, New York, *a*, $93,900; *b*, $3,100; *c*, $1,200.

(*a*) Heating and (*b*) Plumbing same: Richard T. Ford, Rochester, *a*, $3,200; *b*, $3,100. Cleghorn Co., Boston, Mass., *a*, $3,200; Breen Bros., Utica, *a*, $3,875; *b*, $3,275. John L. Fitzgerald, Albany, *a*, $3,290; *b*, $2,860. Sauer & Gorger, Albany, *a*, $3,352; Jas. H. Merrill, New York, *a*, $3,552; Burleson Hardware Co., Niagara Falls, *a*, $3,890; *b*, $3,480. United Htg. Co., New York, *a*, $3,930; John W. Petry, L. I. City, *a*, $3,938; *b*, $3,723. Edw. P. Bates, Albany, *a*, $4,180; J. Anderson & Son, Flushing, *a*, $4,417; Cornelius Dwyer, Amsterdam, *a*, $4,584; *b*, $6,166. W. H. Tobin, Syracuse, *a*, $4,785; *b*, $4,394. Edw. Joy, Syracuse, *b*, $3,200.

Electric Light wiring: John P. Kelly, Schenectady, $3,690; John C. Buchanan, Syracuse, $3,896; Commercial Constr. Co., New York, $4,145; Standard Electric Constr. Co., Rochester, $4,311; Frost & Sheldon, Albany, $4,666; W. M. Sheehan & Co., $4,763; F. E. Andrews, Flushing, $5,000; Edw. Joy, Syracuse, $5,772.

New York, N. Y.—The plans for the naval prison to be erected at Cob Dock have been approved. The building is to be of concrete and steel, 87x44x56 ft., and is to contain 100 reinforced concrete cells.

The following are the bids opened Feb. 21 by John F. Ahearn, Pres. Manhattan Boro., for work in connection with the 13th Dist. Municipal Court:

For masonry, ironwork, renovating, carpentry and glazing, tinning, plastering, etc.—P. J. Ryan, $49,920; D. J. Ryan, $41,900; Jos. Olhausen, $41,442; Springsted & Adamson, $49,375; Hahn & O'Reilly, 3311 3d Ave., $34,619; Wm. Horne Co., $37,573; W. Wright & Son, $44,678; Wm. Werner, $43,536; Louis Wechsler, $42,834; Jas. Disken, $35,248; P. Gallagher, $37,938, and Blaut Realty & Constr. Co., $40,497.

For materials and labor necessary to furnish, install and complete a low-pressure steam-heating apparatus—Frank Dobson, $4,646; United Htg. Co., $3,671; Evans-Almirall Co., $3,915; E. Rutzler Co., $3,964; Jas. Curran Mfg. Co., $4,175; Tullis & Co., $4,437; Geo. A. Suter, $4,900; Rossman & Bracken Co., $4,948, and Wm. Horne Co., 245 W. 26th St., $3,397.

For materials and labor, etc., for plumbing work, etc.—M. J. O'Brien, 835 6th Ave., $3,325; John Spence Co., $5,146; P. J. Ryan, $4,875; Jas Fay Sons, $4,092, and Rossman & Bracken Co., $5,800.

Bids will be received Mar. 21 by John W. Brannan, Pres. Bd. Trus. Bellevue and Allied Hospitals, for furnishing material required for excavating, mason, carpenter, steel, plumbing, electric, ventilating, heating and other work for ambulance station and power house for new Harlem Hospital on Lenox Ave., 136th and 137th Sts.

Geneva, N. Y.—A bill has passed the Assembly providing for the enlargement of the Geneva Armory.

Steubenville, O.—Fred. W. Elliott, of Columbus, it is stated, has been selected to prepare plans for the new infirmary buildings which are to be erected by Jefferson County, at a cost of $100,000.

Bath, O.—Bids will be received Mar. 6 by the Township Trus. for furnishing material and erecting a town hall. Chas. Henry & Sons, Archts., Akron; O. P. A. Ganyard, Clk.

**Columbus, O.*—Chas. H. Frank, Secy. Bd. Pub. Service, writes that the contract for extending and repairing the North Side Market House (bids opened Feb. 15) has been awarded to Bert Walter, of Columbus, for $16,693.

It is reported that, as a result of the bequest of the recent capitalist, W. W. Franklin, plans are to be prepared at once for the Home for the Aged, and probably improvements at the Children's Hospital. Both institutions, it is stated, have been assured of more than $50,000 each.

Lima, Pa.—Henry L. Reinhold, Jr., 430 Walnut St., Philadelphia, architect for the buildings for the insane, to be erected at Lima, Delaware County, writes that bids have not yet been called for; the work will cost about $135,000.

**Newcastle, Pa.*—Fissel & Wagner, of New York, N. Y., have received the contract to erect the U. S. Post Office here, at $66,400. Bids opened Jan. 10.

National Soldiers' Home, Va.—Bids will be received Mar. 15 by B. A. Beeson, Treas. Southern Branch, N. H. D. V. S., for plumbing in K barrack.

Big Stone Gap, Va.—The stone public building in this city, it is reported, has been destroyed by fire.

Sheboygan, Wis.—The Co. Bd., it is stated, has decided to enlarge the Sheboygan County Asylum for the Insane by erecting an additional building, to cost about $50,000.

Toronto, Ont.—Thos. McQueen, Secy. Bd. of Control, writes that the date of opening of bids for the work connected with the erection of the Art Gallery on the Toronto Exhibition Grounds has been extended from Feb. 21 to Feb. 28.

****Items marked thus give the names of parties awarded contracts.***

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—It is reported that the Huntsville Lodge, No. 698, of the B. P. O. Elks, is about to sell $35,000 bonds, for the purpose of erecting a home and theater.

Birmingham, Ala.—It is reported that J. W. Tomlinson has announced that the building on First Ave., owned by he and Mrs. Truner, is to be rebuilt at once. The buildings on Morris and First Ave., owned by Saml. Earle, are also to be rebuilt immediately.

Los Angeles, Cal.—John C. Austin, Douglas Bldg., it is stated, has prepared plans for a $200,000 hotel which is to be erected by Porter & Seemens.

**Denver, Colo.*—Stocker & Frasier, 16th and Lawrence Sts., it is reported, have received the contract to erect a 6-story building for Edw. Hewitt, at 15th and Arapahoe Sts., to cost about $85,000. Gove & Walsh, Archts., 505 McPhee Bldg.

Frank S. Snell, 1624 Curtis St., is said to be preparing plans for contemplated improvements to the Glenarm Hotel, which are to cost about $50,000.

Thos. Keely, Vice-Pres. of the First National Bank, it is reported, intends erecting a 75-room summer hotel at Miramonda, to cost about $40,000.

It is reported that the Fifteenth St. Improv. Co. is having plans prepared by F. E. Edbrooke, 510 Opera House Blk., for an 8-story office building which they propose erecting at 15th and Champa Sts., at a cost of about $300,000.

**New Haven, Conn.*—Wm. Patterson, 844 Chapel St., has secured the contract for putting new roofs on two round-houses of the New York, New Haven & Hartford R. R., at a cost of $40,000.

Pensacola, Fla.—It is reported that the officials of the First National Bank are contemplating the erection of an 8-story bank and office building. The Pensacola Investment Co. may be able to give further information.

J. M. Coe, it is stated, is interested in the erection of a building in this city which is to be known as the Erlanger Theater, and is to have a seating capacity of 1,600 persons.

Lincoln, Ill.—The local unions of the United Mine Workers are having plans prepared by Deal & Ginzel, of Lincoln, for the erection of a $12,000 building to be used as an office building and to contain a meeting hall for miners' unions.

Chicago, Ill.—Henry Ottenheimer, 109 Randolph St., has revised the plans for the building to be erected at W. 18th and Brown Sts., for M. Schrayer's Sons & Co. It will be a combination of factory and warehouse, 5 stories high, 75x100 ft., of mill construction, and will cost $50,000. The same archt. is preparing plans for a 7-story warehouse for Callaghan & Co., law-book publishers, to be erected at 221 W. Taylor St. Cost $25,000.

Holabird & Roche, 1618 Monadnock Bldg., are preparing plans for a 10-story mercantile building, 74x100 ft., to be erected by Aaron E. Nusbaum at 309-313 S. Clark St.; cost approximately $250,000.

Mrs. Ida Richardson, it is stated, will erect a 5-story brick and stone store and office building on Canal and W. Madison Sts.; cost, $40,000.

C. W. Nothnagel, 914 W. 67th St., has designed a 2-story lodge hall, to be erected on Yale Ave. and 63d St., for the Cook County Lodge, No. 240, of the I. O. O. F. It will be 50x130 ft., and cost $35,000.

Plans have been prepared for the following buildings: Six-story shoe factory, 75x75 ft., to be erected at Clinton and W. Adams Sts., for Florsheim & Co., cost $60,000; 7-story warehouse, 25x102 ft., at 231 W. Taylor St., for Callaghan & Co., cost $25,000; 3-story bank building, 25x100 ft., at Highland Park, for the Highland Park State bank, cost $25,000.

John Z. Vogelsang, it is stated, has secured the building at 176 Madison St., and will remodel the same, at a cost of $25,000.

The Columbia Electric Vehicle Co., it is reported, has secured a lease of the property at Michigan Ave. and 13th St., and has had plans prepared by Richd. E. Schmidt, 172 Washington St., for a 2-story building, to cost about $35,000.

Jas. Clare, it is reported, intends erecting a 10-story mercantile building at 5th Ave. and Van Buren St., at a cost of $150,000.

It is stated that John A. Carroll will erect a 5-story fireproof storage warehouse on Cottage Grove Ave. and 52d St., to cost $100,000.

The officials of the Corn Exchange National Bank, it is stated, intend erecting a 6-story building on La Salle St.

Benj. H. Marshall, 28 Jackson Boule., is preparing plans for a 4-story fireproof clubhouse, 93x96 ft., of brick and stone, for the Chicago Automobile Club; cost, $150,000.

The Miller Block at 133-139 Clinton St., it is reported, has been destroyed by fire.

Levy Mayer has purchased the Medinah Temple at 5th Ave. and Jackson Boule., and it is stated, intends making improvements to the upper stories, at a cost of about $100,000.

Ava, Ill.—A company is reported organized here by Claude Wetmore, of St. Louis, Mo., and W. W. Husband, of Ava, to erect a sanitarium.

Clyde, Ill.—It is reported that a $2,000,000 round-house is to be erected this spring by the Burlington R. R. Co. (T. E. Calvert, Ch. Engr., Chicago, Ill.).

Peoria, Ill.—Robt. Hotchkiss, 109 S. Jefferson Ave., it is stated, is the archt. for a hotel which Wm. G. Schmid contemplates erecting at 110 First St., at a cost of $25,000.

La Salle, Ill.—It is stated that plans are being prepared for a $20,000 extension to the Harrison Hotel.

Geneva, Ind.—It is reported that the Trus. of the I. O. O. F. have been directed to receive plans and bids for erecting a 2-story building, to cost about $10,000.

**Sioux City, Ia.*—F. X. Babur & Sons, 408 Mass Bldg., it is reported, have received the contract to erect at 618 4th St., the Badgerow Bldg., at a cost of $18,000. The building will be 3 stories high, and used for stores and offices.

Des Moines, Ia.—It is stated that the members of the United Commercial Travelers of America are contemplating the erection of a home to cost about $200,000 and will probably locate in this city.

Council Bluffs, Ia.—The members of the Masonic bodies and the Royal Arcanum, it is reported, are contemplating the erection of a 4-story fraternity building to cost about $40,000.

**Kansas City, Kan.*—It is reported that the contract to rebuild the Chicago Great Western elevator has been secured by Barnett & Record, of Minneapolis, Minn. It is to have a capacity of 1,000,000 bushels, and is to cost about $150,000.

Reports state that the trus. of the Y. W. C. A. propose to erect a building to cost $20,000. C. L. Brokaw is member of the Bd. of Trus.

**Argentine, Kan.*—Chas. Fellows, of Topeka, it is reported, has received the contract for the substructure for the $400,000 elevator which the Santa Fe R. R. Co. intends erecting here.

Lawrence, Kan.—It is stated that bids will be received until Feb. 28 by W. J. Coleman, Secy., for erecting a brick and stone Y. M. C. A. building. Frank E. Wetherell, Archt., Oskaloosa.

Crowley, La.—Mrs. Roberts, proprietress of the Crowley House, it is reported, is contemplating the erection of a building on the site of the present Crowley House, which is to cost about $30,000.

New Orleans, La.—The members of the Automobile Club of New Orleans, it is stated, are contemplating the erection of a country club-house and garage.

Bangor, Me.—T. L. Dunn, of Portland, Ch. Engr. Maine Central R. R. Co., writes that Henry B. Fetcher, of Melrose, Mass., is the architect for the passenger station to be erected at Bangor. Estimates not yet completed.

**Baltimore, Md.*—Wm. Ferguson & Bro., of Baltimore, it is reported, has received the contract to reconstruct the bank and office building of the Commercial & Farmers' Bank, which is to cost about $40,000.

Wyatt & Nolting, of Baltimore, it is stated, are preparing plans for a 6-story building to be erected by the Singer Mfg. Co., at Liberty and Lexington Sts., to cost about $100,000.

*A building permit has been granted to Laura V. Bowie and C. G. Carmina to erect a 5-story building on Howard and Franklin Sts., to cost $50,000. Fredk. Decker & Son, builders, Baltimore; also to W. G. Speed, to erect an 8-story office building on Cortlandt and Saratoga Sts.; cost, $88,000; R. H. Frazier & Son, of Baltimore, builders.

*Jacob Peters, of Baltimore, it is reported, has received the contract for erecting a 5-story bonded warehouse at First and Fort Aves., for the Canton Distilleries Co., at a cost of about $22,000.

South Hadley, Mass.—The directors of the Hadley Mills, it is reported, have authorized the erection of a 3-story brick 40x114-ft. building adjacent to the Hadley Mills office, to be devoted to weaving. It is stated that the contract for its erection has not as yet been let. Caspar Ranger, of Holyoke, is the archt.

Leominster, Mass.—Edwin T. Chapin, State Mutual Bldg., Worcester, it is reported, is preparing plans for an addition to the car-house of the Worcester Consolidated St. Ry Co. at Leominster.

**Kalamazoo, Mich.*—J. M. Biggerstaff, 210 Main St., it is stated, has received the contract to erect for the Michigan Traction Co., at 135 Portage St., 2 buildings, 1 a 3-story brick office building, 40x70 ft., the other a brick freight house, 25x65 ft. The approximate cost of the 2 buildings is reported to be about $20,000.

Vicksburg, Miss.—The Pythians of this city are said to be contemplating the erection of a 5-story and basement building at South and Walnut Sts.

Jackson, Miss.—It is reported that the directors of the Mississippi Masonic Widows' and Orphans' Home are considering the selection of a site somewhere in the State, on which it is proposed erecting a home, at a cost of $40,000.

**St. Louis, Mo.*—The Emporium Realty Co., it is reported, has purchased the site at Washington Ave. and 6th St., and intends erecting a department store, 8 stories high, to cost about $1,000,000. Mauran, Russell & Garden, 721 Olive St., are the archts., and the Westlake Constr. Co., 510 Pine St., are the builders.

Omaha, Neb.—The following are reported to be the bids opened Feb. 11, by J. L. Brandeis & Sons, for excavating the site at 17th and Douglas Sts., on which it is proposed erecting their 7-story building. It is estimated that about 33,000 yds. of earth will be removed: John A. O'Keefe & Co., 45 cts. per cu. yd.; T. C. Jackson & Co., 46.9 cts.; W. F. Arnold, 47.5 cts.; S. Cox & Co., 48.3 cents; A. A. Lamoreaux, 48.5 cts.; Jas. P. Connelly, 49 cts.; Sawtell & Winn, 52 cts.; Phelan & Shirley, 52 cts.; Gust Hamel & Co., 55 cts.

Newark, N. J.—The Central R. R. of New Jersey (Jos. O. Osgood, Ch. Engr., Jersey City), it is reported, is having plans prepared for a 6-story brick and stone storage warehouse which is to be erected at Lawrence, Mechanic and Ward Sts., this city, at a cost of about $500,000.

Buffalo, N. Y.—It is reported that the 5-story brick building at 369 Elliott St., owned by I. B. Taylor, has been destroyed by fire.

Syracuse, N. Y.—The erection of a Y. M. C. A. building, at a cost of about $300,000, is reported under consideration.

Schenectady, N. Y.—It is reported that Attorney Chas. Hastings is contemplating the erection of a 3 or 4-story brick and stone store and office building, and is having plans prepared for the same by Arthur G. Lindley.

Niagara Falls, N. Y.—Local press reports state that bids will be received by the Chmn. of the Bldg. Com. until Mar. 1 for erecting a 3-story and basement brick Y. M. C. A. building. Seymour & Paul A. Davis, of Philadelphia, Pa., are the Archts.

Brooklyn, N. Y.—It is reported that a number of the prominent Roman Catholics of the Borough are contemplating the erection of a Y. M. C. A. building under R. C. auspices, to cost about $50,000.

Youngstown, O.—The Bauman Ice Cream Co., it is reported, will erect a 3-story business block on Boardman St. this spring.

Wellsville, O.—E. G. Whitacre, it is stated, is preparing plans for a 3-story brick business block and apartment house which is to be erected on 18th St. and Clark Ave., by G. M. Aten, at a cost of $30,000.

Massillon, O.—The Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore, Md.), it is stated, will erect a station here, to cost $30,000.

Columbus, O.—The Bldg. Com. of the New Straitsville Athletic Club, it is reported, has rejected all bids recently received for erecting the club-house, and new bids are to be asked.

Monroe Heath Blake is said to be archt. for a 4-story brick and sandstone building which is to be erected at Walnut St. by Geo. Jamison.

Frank L. Packard, Archt., Columbus, writes that plans for the proposed 16-story office building to be erected on E. Broad St. for the Capitol Savings & Trust Co. will be ready in about 6 weeks.

Cincinnati, O.—The Union Terminal R. R. Co. is contemplating the construction of a terminal subway from Bway. to Millcreek; the plans include a terminal station to occupy the block between Race, Canal, Court and Vine Sts., and the erection of an 8-story building to accommodate the general offices of the railroads interested. A construction company is to be formed for the purpose of constructing the contemplated improvements, and Geo. R. Scrugham is to be Pres. and Gen. Mgr.

Toledo, O.—See "Railroads."

Youngstown, O.—The Banner Electric Co. will, during the summer, erect a 3-story factory, 40x120 ft. No additional power will be required.

Norristown, Pa.—J. J. Ferry contemplates erecting a stable 3 stories high, 50x100 ft., with elevator, etc.

York, Pa.—It is reported that the Directors of the York Hotel Co. are contemplating improvements to the Colonial Hotel to cost about $90,000.

Reading, Pa.—It is reported that the Widows' Home recently destroyed by fire is to be rebuilt.

Philadelphia, Pa.—It is reported that Carl P. Berger will receive bids until Mar. 1 for the erection of the German Theater on Girard Ave. and Franklin St. It is to be 5 stories high, of brick and stone, the 4 upper stories to be used for offices. Probable cost, $150,000.

The following are reported to be the bids received by T. P. Chandler, Archt., 328 Chestnut St., for erecting additions to the Fidelity Trust Co. Bldg., on Chestnut and 4th Sts.: J. E. & A. L. Pennock, $102,492; Cramp & Co., $103,921; Thos. Little & Son, $104,100; Wm. R. Dougherty, $112,000; Jas. Johnston, $114,200; Chas. Gilpin, $115,965; Stacy Reeves & Sons, $117,420; Arthur H. Williams' Sons, $118,240; the Wells Bros. Co., $131,600.

Easton, Pa.—E. J. Richards is about to build large store and building on Northampton St.

The Easton Trust Co. is about to erect a large addition to its present building in Center Sq.

**Pittsburg, Pa.*—Thos. Reilly, of Philadelphia, it is reported, has received the contract to erect a parish house on Oliver St. for the Trinity Episcopal Church, at a cost of about $35,000.

Shenandoah, Pa.—It is reported that the Hooven Mercantile Co., of N. Y. City, wholesale grocers, has completed arrangements to erect a warehouse here, to cost about $25,000.

Spartanburg, S. C.—It is reported that I. H. Greenewald will erect a theater here.

Salt Lake City, Utah.—Plans are being prepared for a masonic temple to be erected near Eagle Gate, to cost $80,000. It is to be of stone, and have club and lodge rooms.

A. Fred. Wey, prop. of the Wilson Hotel, it is stated, is considering the erection of a hotel to cost $35,000.

Walla Walla, Wash.—The erection of a Y. M. C. A. building to cost, including furnishings, about $50,000, is reported under consideration. W. G. Coleman is Chmn. of Com. having the matter in charge.

North Yakima, Wash.—It is reported that the Northwest Light & Water Co. intends erecting an office building in this city, to cost $20,000.

Seattle, Wash.—It is stated that bids be received until Mar. 15 by Jas. Steph 726 New York Bldg., for erecting a Y. C. A. building, 120x120 ft.; cost, $125,0 A. S. Allen, Secy.

Josenhans & Allan, 74 Hinckley Blk., i reported, have been authorized to pre plans for the steel and brick theater w J. A. Moore intends erecting on 2d Ave., cost of $350,000.

Seattle, Wash.—Saunders & Lawton, N York Blk., it is stated, are preparing p for two additional stories to be erected to Bon Marche Blk., owned by W. D. Trim The cost estimated at $40,000.

It is reported that the 8-story building the Schwabacker Hardware Co., at Jack St. and First Ave., has been destroyed by

**Wheeling, W. Va.*—The Riverside Bri Co., of Wheeling, has secured the contr for the structural iron work for the Schw bach Bldg. on Market St.; contract price ported to be $100,000.

Milwaukee, Wis.—A. C. Eschweiler, Wisconsin St., it is stated, is preparing pl for a $300,000 5-story brick and stone bu ing which is to be erected by the Wiscon Telephone Co., on 5th St. and Grand Ave.

*The contract to erect the $60,000 fac for the Enterprise Box Co., it is stated, been secured by the Frank Luenzman Co

John Roth, Jr., 307 Grand Ave., it is ed, has prepared plans for a $20,000 4-s flat and store building to be erected for Schomberg at 4th and Sycamore Sts.

Eau Claire, Wis.—It is reported that Scandinavians are preparing to erect a 000 hotel. Peder Tangjerd, Secy.

Montreal, Que.—It is reported that Credit-Foncier Franco-Canadian Co. has chased a site at St. James St. and Lam Hill, and will erect a 10-story office buil to cost $400,000.

NEW YORK, N. Y.

332 W 11th St, 5-story br and stone st bldg; c, $30,000; o, Foster, Scott Ice Co Thos H Styles.

36 E 23d St, 10-story br and stone and studio bldg; c, $65,000; o, F A Sea a, Fred C Zobel.

247 E 119th St, 6-story br and stone and tenemt; c, $40,000; o, David Herr a, Sass & Smallheiser.

121st St and 2d Ave, 6-story br and s store and tenemt; c, $52,000; o, Abra Levy; a, Edward A Meyers.

St Nicholas Ave and 168th St, 2-stor and stone store and office bldg; c, $20, o, L J & S J Reckendorfer; a, Small & S mann.

Westchester and Bergen Aves, 10-stor stores, offices, etc; c, $325,000; o, W Keogh Amusement Co; a, Neville & Bag

414 Bway, alterations to 6-story br stone store and loft bldg; c, $35,000 Surety Realty Co; a, David Stone.

109th St and Park Ave, 2 6-story br stone stores and tenemts; total c, $96, o, Gordon, Levy & Co; a, Edward A Mey

CHURCHES AND DWELLINGS

Notes Arranged Alphabetically by Stat

Denver, Colo.—John D. McGilvray, stated, intends erecting a gray pressed apartment house on E. 11th Ave. and C St., to cost $60,000.

Chicago, Ill.—C. Whitney Stevens, Dearborn St., has been selected to pr plans for the Diversey Boule. M. E. Ch to be built at Sheffield Ave. and Georg It will be a one-story structure, 91x13 of brick and stone, and cost $35,000.

Chicago, Ill.—L. Mart Mitchell, 14 Salle St., has prepared plans for a 3- apartment building, 99x165 ft., to be at Park Ave. and 59th St., for W. L. cost, $75,000.

Walter & Gobel are the architects apartment building for Edgewater, whi to consist of three 3-story sections. The is estimated at $50,000.

Thos. McCall, 167 Dearborn St., has pleted plans for a 3-story apartment to be erected in Madison St., near Ga Park, to cost $40,000.

Plans are being prepared by T. N. Bel Van Buren St., for a 3-story brick and apartment house, 130x50 ft., to be erect St. Lawrence Ave. and 46th Pl.; cost, 000.

Geo. W. Stewart will erect a 3-story and stone apartment house, 175x125 f Sheridan Road and Rokeby St. It will $80,000.

D. Robertsonn has prepared plans f apartment house to be built by Colli Morris, at Indiana Ave. and 42d St. I be a 3-story structure, and cost about $7

Wichita, Kan.—It is reported that the of the Baptist Church have decided to a new edifice on the site of the present ture, the cost to be about $30,000. R W. Cassidy, Pastor.

Detroit, Mich.—Jos. E. Mills, 510 ington St., it is reported, has prepared for the North Woodward Ave. Baptist C which is to be erected on Woodward Ave Grand Boule., at a cost of $75,000; also for a pressed brick and stone residence erected at Putnam Ave. and Woodward S cost $23,000.

Kansas City, Mo.—The Williams Co., it is stated, has secured a permit to a 4-story apartment house at 1100 A Boule., estimated to cost $25,000.

Joplin, Mo.—It is reported that the bers of the First M. E. Church have acc plans for a new edifice which it is pro erecting at a cost of $30,000. Rev. Jones, Pastor.

****Items marked thus give the names of parties awarded contracts.***

York, N. Y.—Plans have been filed for ory dwellings to be erected at 984 5th r Isaac V. Brokaw, at an estimated $100,000. Chas. Fredk. Rose, 1 Madi- ., is the archt.

lo, N. Y.—A 3-story brick apartment 6x165 ft., is to be erected on Buffalo d 3d St. by the International Bldg. a cost of $60,000.

io, O.—L. G. Welker, "The Spitzer," ported, is preparing plans for a 3-story be erected by F. A. Lawrence, at Jef- Ave. and 21st St., at a cost of $30,-

burg, Pa.—Beezer Bros., 6200 Penn t is stated, are preparing plans for a ce which is to be erected at Beech- Boule. and 5th Ave., and is to cost $100,000. It is reported that bids for ction will be taken in about a month. H. Sims, 505 Monon National Bank it is reported, is preparing plans for and stone residence to be erected for R. Gregg, in Woodland Road and Wil- ve., and is to cost about $60,000.

ading, Pa.—Geo. W. Beard & Co., of g, it is stated, have received the con- to erect a 3-story apartment house, 20x . for Geo. W. Biehl, on S. 5th St.

ristown, Pa.—A 4-story extension, 50x , will be added to the Hamilton Apart- House on Hamilton and Main Sts. ellings will be erected as follows: By . Althouse, on Selma and Main Sts.; $12,000; by Perry Gresh, on Main St. ranklin Ave.; cost, $15,000, and by L. uble, on s. side of Main St.; cost, 00.

k, Pa.—C. A. Keyworth, of York, it is ted, is the archt. for a residence which . Robt. Kopp intends erecting, at a cost out $30,000.

ttle, Wash.—It is reported that the Bd. rectors of the First Presbyterian Church ontemplating the erection of a new edi- at a cost of $125,000.

ns have been prepared for the Nether- Mortgage Co. for a 3-story apartment- to be erected at 9th Ave. and Pike St., cost of $17,000.

NEW YORK, N. Y.

E 55th St, 6-story br and stone dwell- c, $30,000; o, Thos J McLaughlin; a, ent B Brun.

3d St and 2d Ave, 6-story br and stone nt; c, $25,000; o, Meyer Ludman; a, stein & Bernstein.

adison Ave and 96th St, 6-story br and tenemt; c, $175,000; o, Wm F Rohrig; eo F Pelham.

1th St and 7th Ave, 2 6-story br and tenemts; total c, $110,000; o, Jacob owsky; a, Geo F Pelham.

1st St and Bway, 4 5-story br and stone mts; total c, $152,000; o, Silverson & f; a, Geo F Pelham.

E 67th St, 4-story br and stone exten- to 3-story br and stone dwell; c, $20,-; o, Mrs A Glyne; a, John H Knubel.

SCHOOLS.

otes Arranged Alphabetically by States.

astlake, Ala.—The Com. on Endowment of vard College, it is reported, has decided to t a scientific hall, at a cost of $15,000.

nniston, Ala.—Chas. W. Carleton & Co., Anniston, it is stated, have been engaged prepare plans for the Synodical College, ch is to be either 3 or 4 stories high, and about $30,000.

ariana, Ark.—The Bd. of School Direct- it is stated, has petitioned the legislature a special act to allow them to issue bonds the erection of a school on the site of one destroyed by fire on Feb. 3. It is re- ted to be the intention of the Directors erect a 2-story brick structure, to cost ut $20,000.

Sacramento, Cal.—A bill has passed the ate appropriating $35,000 for the erection a domestic science building at the Califor- . Polytechnic School, and also a bill appro- ating $250,000 for improvements at the lifornia Polytechnic School.

ndianapolis, Ind.—It is stated that plans ve been prepared by Rubush & Hunter, for 0-room addition to be erected to the Haugh- le School, at a cost of about $50,000.

Versailles, Ind.—It is reported that bids e wanted Mar. 4 for erecting a school in elby Township, Dist. No. 3. Albert J. ance, Township Trus.

Ft. Wayne, Ind.—Archt. R. A. Bradley, and cht. Frank Allen, both of Ft. Wayne, are eparing plans for schools, each to cost 5,000.

Muncie, Ind.—The School Bd. is said to be nsidering plans for the erection of a school the north side, to cost about $45,000.

Winchester, Ky.—The Kentucky Wesleyan llege, the official school of the Southern ethodist Church, it is reported, has been stroyed by fire.

Baton Rouge, La.—Bids are wanted Mar. for erecting a modern school. L. M. eathers Co., Archts., Memphis, Tenn.; W. Bynum, Mayor.

Arcadia, La.—The citizens are reported to ve voted in favor of a 5-mill tax for 10 ars to erect a school in Dist. No. 1, to cost out $20,000.

Baltimore, Md.—The Municipal Bd. of Awards has rejected all bids recently received for erecting the Eastern High School at Bway. and North Ave., and will again receive bids for its erection on Mar. 1. Plans may be secured on the deposit of $100, the same to be refunded if plans are returned in good condition before the opening of bids. Edw. D. Preston, Inspector of Bldgs.

Haverhill, Mass.—The erection of a high school—the cost, including site and building, to be about $200,000—is reported under consideration.

Owosso, Mich.—Bids will be received Mar. 2 by J. D. Estes, Secy. Bd. Educ., for erecting an 8-room school. G. M. Edwards & Co., Archts., Hall Blk., W. Main St.

Germfask, Mich.—It is reported that bids will be received Mar. 1 by J. M. Stauffer, Clk. of School Bd., for erecting school in Sub-district No. 3.

Ann Arbor, Mich.—The School Bd., it is reported, has reconsidered its recent action in selecting an archt. for the high school, and has engaged Malcolmson & Higginbotham, of Detroit, to prepare the plans.

Appleton, Minn.—Press reports state that bids are wanted Mar. 1 for erecting a high school; bids for heating to be submitted separately. Downs & Eads, Archts., 208 New York Life Bldg., Minneapolis.

Starbuck, Minn.—It is reported that bids will be received Mar. 15 by the Clk. of School Bd. for erecting a $12,000 school.

St. Louis, Mo.—The following are reported to be the bids selected for recommendation from those recently received for the Shields School and addition of 3 rooms to the Dessalines School: Shields School—General work, Hiram Lloyd Bldg. and Constr. Co., $161,-357; plumbing, Fink & Schuster Plumbing Co., $9,230; heat and ventilating, B. F. Sturtevant Co., $20,678. Addition of 3 rooms to the Dessalines School—General work, Kellerman Constr. Co., $37,800; plumbing, Fink & Schuster Plumbing Co., $4,890; heating and ventilating, National Heating Co., $8,899.

Plans are being completed, according to reports, for a mission school which is to be erected for the Church of the Messiah at Taylor and Berlin Aves., at an estimated cost of $30,000. Address pastor.

Hammonton, N. J.—It is reported that an 8-room school is to be erected here, at a cost of $15,000.

Lascruces, N. M.—It is reported that bids are wanted Mar. 20 for erecting a school. Isadora Armigo, Chmn. School Bd.

New York, N. Y.—Bids will be received Mar. 6 by C. B. J. Snyder, Supt. School Bldgs., for erecting outside iron stairs on School No. 56; for sanitary work and gas-fitting in De Witt Clinton high school; for installing, ventilating and heating apparatus in Schools Nos. 15 and 104, and for erecting, including plumbing and drainage, School No. 65, all in Boro. Manhattan; bids will also be received on same date for sanitary work and gas-fitting in School No. 41, Boro. Bronx.

Port Chester, N. Y.—The citizens have voted in favor of issuing $13,000 bonds to erect an addition to the present primary school known as Brooksville School.

New Rochelle, N. Y.—The Aldermen have voted in favor of erecting a high school at a cost of $150,000, on North Ave.

Middletown, N. Y.—The School Bd., it is stated, is considering the erection of a school at a cost of $27,000.

Canandaigua, N. Y.—The following are reported to be the bids received Feb. 4 for work in connection with the erection of the Academy Bldg.:

General Construction—F. X. McNulty, $88-676; Halliman Bros., $86,748; Frank G. Gilbraith, $117,349; John V. Sheffer & Co., $90,-967; John O'Connor & Bro., $82,000; Dennison & Co., $80,957; Jas. E. Laney & Co., $70,355; B. U. Taylor & Co., $72,712; A. M. Carpenter, $73,680; H. Probit, $93,200; Fletcher Bros., $85,474; Ambrose B. Stanard, $84,-220; Drake & Co., $82,587.

Electric Work.—McNerney & Powers, $4,-191; Edwin R. Pease, $4,380; J. P. Little Co., $2,823; Wheeler Green Elec. Co., $4,-448; Allen B. Lang, $3,850; Standard Elec. Co., $4,600; McDonnell & Dumond, $3,790; Edward Joy, $4,452.

Heating Plant.—McDonnell & Dumond, $14,500; Goldea & Gildea, $13,169; N. Y. Steam Fit. Co., $11,216; Breen Bros., $10,-802; Edward Joy, $13,410; J. S. Goodnow, $9,489; Smith & Anthony Co., $12,336; C. Dwyer, $14,793; Frank H. Fals, $14,695.

Plumbing—Edward Joy, $6,775; P. B. Downs, $6,500; C. Dwyer, $6,388; A. A. Sterling, $6,444; F. H. Fals, $5,998; LeValley, McLeod & Co., $6,382.

It is stated that plans are to be revised so as to bring the cost within the $80,000 appropriation.

Youngstown, O.—It is reported that Rev. M. P. Kinkade, Pastor of the Immaculate Conception Church, has had plans prepared by W. T. Guenther, of Akron, for a school which is to be erected opposite the church, at a cost of about $75,000, and the contract will be awarded about Mar. 1.

**Cleveland, O.*—It is reported that Watterson & Schneider, Archts., have awarded the contracts for erecting a Physics Bldg. at the Case School of Applied Science as follows (probable total cost, $80,000): General contract to Saml. Austin & Son Co., 1257 Bway.; masonry and cut-stone, to Griffing& Co.; iron and steel work, to the National Iron & Wire Co.

**Durham, N. C.*—S. Bowling, it is reported, has received the contract to erect a school in Geer School Dist., and another in Peeksville Dist. for the Co. Bd. of Educ.

**Helena, Okla. Ter.*—E. S. Wilhite, Secy. School Bd., writes that the contract for erecting a school (bids opened Feb. 10) has been awarded to T. O'Keefe, of Oklahoma City, for $32,850.

Pittsburg, Pa.—D. L. Gillespie, Pres. of the Central Bd. of Educ., it is reported, is in favor of erecting a new high school this year.

Shamokin, Pa.—Bids will be received Mar. 6 by the School Bd. for $25,000 school bonds. John Harris, Secy.

Philadelphia, Pa.—Plans have been completed for the Southern Manual Training School which is to be erected at Broad and Jackson Sts., and it is reported that bids for its construction will be opened by the Property Com. about Mar. 7. Appropriation, $330,000.

Columbia, S. C.—It is stated that bids are wanted Mar. 9 by J. T. Barron, Chmn. Bldg. Com., for erecting a school. Edwards & Walker, Archts., Columbia.

Chattanooga, Tenn.—It is reported that plans are being prepared for a brick school which is to be erected in Sherman Heights, at a cost of about $10,000.

Hilbert, Wis.—It is stated that bids will be received until Feb. 28 for erecting a school. Wm. Schmidler, Clk.

Delavan, Wis.—It is stated that bids are wanted Mar. 8 for erecting a school. Arthur Bowers, Clk. School Bd.; Chandler & Park, Archts., Racine, Wis.

Chippewa Falls, Wis.—It is reported that bids will be received Mar. 15 by the Clk. of School Bd. for erecting a school.

Galt, Ont.—Bids will be received Mar. 4 by Thos. Carscadden, Secy., for erecting a collegiate institute building here. Stewart & Witton, Archts., Hamilton.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Chicago, Ill.—The financial budget is reported to contain an appropriation of $200,-000 for garbage stations with cement floors and side tracks in different portions of city.

Atlantic City, N. J.—The following are reported to be the bids opened on Feb. 13 by the City Council for the collection of garbage from Feb. to Sept.: Atlantic Products Co., Atlantic City, $9,900; Francis S. Murtland, Phila., $13,490; Andrew Marcus, $13,885, and Francis B. Coll, $14,300.

New York, N. Y.—The following are the bids opened on Feb. 15 by John McG. Woodbury, Comr. of Street Cleaning, for the construction of a rubbish incinerator at Delancey Slip: Ralph J. Gerstle Co., 347 E. 44th St., $31,000; W. L. & G. H. O'Shea, $35,765; Luke A. Burke & Sons, $32,750, and Abbott, Gamble Co., $35,658.

Long Island City, L. I., N. Y.—Bids will be received Mar. 6 by Jos. Cassidy, Pres. Boro. Queens, for furnishing material and constructing a plant for final disposition of garbage, rubbish and light refuse to be collected in 4th Ward of said Boro.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Lorain, O., Sand & Gravel Co. is in the market for a 10-ton locomotive crane, with 35 to 50-ft. boom, fitted for operating a clam shell.

The United States Safe Co., Elizabeth, Pa., intends to install some new machinery for heavy vault work during the late summer or early fall.

The West Allis, Wis., Malleable Iron & Chain Belt Co. will enlarge its foundry by building a 70x208-ft. addition, at a cost of over $20,000.

W. H. Aldridge, Beaumont, Tex., will build a single circular saw mill of 80,000 to 100,-000-ft. capacity. A 24x30-in. engine and four 18-ft. boilers of 72 in. diameter, with 4-in. tubes, will be used.

The Armstrong Bros. Tool Co., 617-621 Austin Ave., Chicago, will erect a new plant on a 213x197-ft. site at North San Francisco Ave., and the C. & N. W. Ry. The building will be 3 stories and basement, 60x175 ft., with a 30x175-ft. furnace-room extension, and will be of brick mill construction. The company expects to install motors, current being taken from the Commonwealth Electric Co., and a steam-heating plant will be installed later.

The United States Casket Co., 145 La Salle St., Chicago, Ill., is in the market for a 5,000-lb. freight elevator, pulleys and belting.

The new plant to be erected by the Indiana Drain Tile Co., mentioned Feb. 4, will be located at Brooklyn, Ind.

O. A. Abrahamson, Lock Box 85, Bloomer, Wis., is secretary of a company which has been formed to erect a 40x200-ft. starch factory.

The Pineville, Ky., Electric Light Co. contemplates installing an ice plant.

The Halls, Tenn., Box Co. will erect a building about 60x100 ft. in size, and is in the market for an engine of about 100-h.-p. capacity; a boiler of about 120-h.-p., woodworking machinery, shafting, pulleys, belts, hangers, etc.

The Pansy Lumber Co., Mears Bldg., Scranton, Pa., expects to make a number of improvements in its mill at Pansy, Ala., which may consist of the erection of an entirely new mill.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

England, Ark.—Bids will be received Mar. 20 by the Plum Bayou Levee Bd. for constructing levee from Wild Cat Bayou Station 700 south to Station 1651, containing approximately 1,403,000 cu. yd. R. B. Eggleston, Ch. Engr.

Denver, Colo.—W. E. Bates, Coronado Bldg., Denver, Secy. High Line Irrig. Dist., writes that it was voted Jan. 30 to issue $1,100,000 bonds for the purpose of buying the canal from Platte Cañon to the Scranton coal banks, and for the construction of a reservoir in Platte Cañon below Cheesman dam, with a capacity of 2,000,000 cu. ft. of water.

Washington, D. C.—Bids will be received Mar. 15 by the Disbursing Officer, Signal Corps, U. S. A., War Dept., Washington, for furnishing the following cable: 20-mile type 41 and 10-mile type 31 to be stored by manufacturer; 25,000 ft. type 217 and 25,000 ft. type 218, to be delivered on reels, at Black Tom Wharf, Communipaw, N. J.

The Senate Com. on Post Offices has added to the post office appropriation bill $1,000,-000 for extending the pneumatic tube service.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Dixon, Ill.—H. U. Bardwell, City Clk., writes that G. H. T. Shaw, of Dixon, is reported interested in the construction of a dam at Grand Detour, on Rock River, near Dixon.

New Orleans, La.—Bids will be received Mar. 25, by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for grading and filling at naval station here. Funds available, $25,000.

Chicago, Ill.—The following are the bids opened on Feb. 15 by the Bd. of Trus. Sanitary Dist. of Chicago for dredging the main Chicago River and south branch of Chicago River, and docking a portion of the river front contiguous to the portions dredged together with other work; (1) Chicago & Great Lakes Dredge & Dock Co., Chicago; (2) Fitzsimmons-Connell Co., Chicago; (3) Buffalo Dredge Co., Buffalo:

	1.	2.	3.
(*a*) 880,000 cu. yd. excavation deposited by contractor	$0.245	$0.24	$0.26
(*b*) 880,000 " excavation deposited on Lake Front	.245	.34	...
(*c*) 105,600 " excav. (scow meas.), dep. by contractor	.149	.155	.17
(*d*) 105,600 " excav (scow meas.), dep. on Lake Front	.149	.26	...
(*e*) 1,720 lin. ft. dock removed	1.75	1.50	2.00
(*f*) 200 piles (pulling and removing)	1.75	1.25	1.40
(*g*) 800 lin. ft. pile dock (completed triple sheet)	23.25	26.00	26.80
(*h*) 800 " pile dock (single thick sheet)	17.75	20.50	23.00
White oak piles, per lin. ft.	.31	.29	.33
Hard wood piles, per lin. ft.	.20	.19	.25
Sheet piling, per M. ft.	55.00	55.00	60.00
White oak timber, per M. ft.	50.00	52.50	60.00
Oregon fir caps, per M. ft.	44.00	45.00	50.00
Pine timber, per M. ft.	40.00	45.00	50.00
Pine stringers, per M. ft.	38.00	40.00	50.00
Hemlock timber, per M. ft.	35.00	40.00	45.00
Anchor Rods, per lb.	.05	.05	.065
Screw bolts, per lb.	.06	.055	.06
Wrought iron drift bolts, per lb.	.04	.045	.05
Spikes and nails, per lb.	.04	.04	.05
Total with *a* and *g*	$43,520	$44,750	$48,040
" " *b* and *g*	43,520	53,550	......
" " *c* and *g*	37,694	39,998	43,112
" " *d* and *g*	37,694	51,086	......
" " *a* and *h*	39,120	40,350	45,000
" " *b* and *h*	39,120	49,150	......
" " *c* and *h*	33,294	35,598	40,072
" " *d* and *h*	33,294	46,686	......

Jackson, Mich.—According to plans proposed by City Engr. A. B. Stevens, the Grand River will probably be dredged through and below the city, a distance of from 6 to 10 miles. An application to place the matter in the hands of the Drainage Comr. is in circulation.

Detroit, Mich.—The following are the bids opened on Feb. 16, by Lieut. Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., for dredging in lower Detroit River (about 1,200,000 cu. yds). The material to be removed is mainly of sand, clay, silt, a few boulders and hard pan, but no bedrock; price given per cu. yd. Chicago & Great Lakes Dredge & Dock Co., Chicago, Ill., 28½ cts.; Samuel O. Dixon, Milwaukee, Wis., 31½ cts.; Detroit Dredging Co., Detroit, 29 cts.; Buffalo Dredging Co., Buffalo, N. Y., 33 cts.; G. H. Breymann & Bro., Toledo, O., 27 cts.; Lake Superior Contracting & Dredging Co., Duluth, Minn., 31 cts.; The L. P. & J. A. Smith Co., Toledo, O., 30 cts., and M. Sullivan, Detroit, 29 cts.

Fairmont, Minn.—It is stated that bids will be received Apr. 4 by H. P. Edwards, Co. Aud., for constructing 2 ditches, requiring the removal of about 140,000 cu. yd.; estimated cost, $23,500.

**Items marked thus give the names of parties awarded contracts.*

International Falls, Minn.—See "Power Plants, Gas and Electricity."

Atlantic Highlands, N. J.—The Boro. Council is reported to be considering the eliminating of the meadow land and constructing lakes and a basin for boats; probable cost of the work is $26,000. H. O. Todd, Boro. Engr.

**Asbury Park, N. J.*—The New Jersey Bridge Co. is stated to have secured the contract to furnish and erect the steel work of the amusement pier for the Asbury Park Pier Co., for about $165,000.

New York, N. Y.—The Bd. of Estimate on Feb. 17 appropriated $1,000,000 for new playgrounds and about $3,500,000 for small parks. The largest appropriation for a park was for Chelsea Park, at 9th Ave. and 26th Sts., Manhattan, which is to cost $1,250,000. The other appropriations included $750,000 for the Highland Park extension in Brooklyn, $25,000 for the Ft. Joseph Rodman Drake Park in the Bronx, $400,000 for a park at Barclay, Hoyt and Diamars Aves. in Queens, and $100,000 for the acquirement of title to property at Crotona Ave. and South. Boule. in the Bronx for park purposes. The board also passed appropriations aggregating $925,000 for property in Bay Ridge, Brooklyn, known as Owl's Head.

Arden, N. Y.—Press reports state that the Erie R. R. Co. (C. W. Buchholz, Consulting Engr., New York, N. Y.) will expend about $50,000 in changing the course of the stream at Arden, which at present flows under its tracks at that place and unites with Ramapo River; 25,000 yd. of excavation will be necessary. It will be 25 ft. wide at the bottom, which is to be paved, and the sides walled to a height of 6½ ft.

Buffalo, N. Y.—The following are the bids opened by the Bd. of Superv. on Feb. 14 for completing branch and drain pipes at the proposed 65th Regt. Armory: Barnd & Geiger, $15,995; Timothy McEvoy & Son, $15,641; John F. Weinheimer, $16,500; John D. Smith Co., $16,400, and Edw. Joy, of Syracuse, $16,589.

Brooklyn, N. Y.—Bids will be received Mar. 2, by the Bd. Park Comrs., N. Y. City, for furnishing and delivering plumbing material at Boro. Brooklyn and Queens. John J. Pallas, Pres.

Bids will be received Mar. 8 by Martin W. Littleton, Boro. Pres., for furnishing and delivering 2,000 bbl. Portland cement.

Cleveland, O.—The following are the bids opened on Feb. 17, for dredging in Cuyahoga River, about 25,000 cu. yds., price given per cu. yd.: L. P. & J. A. Smith Co., Cleveland, 28 cts., and the Standard Contr. Co., Cleveland, 32 cts.

**Randolph, O.*—Contracts for constructing the Laubert ditch in Randolph are stated to have been awarded as follows: To Brown & Fuller Contr. Co., of Elyria, for the dredge work, $5,886, and to Hellinan Bros., of Akron, for the hand work, at 23.9 cts. per cu. yd.

**Columbus, O.*—The State Bd. of Pub. Wks. is stated to have awarded contracts for constructing the northern division of the Ohio Canal as follows: Cement, Miles & Murphy, Columbus, $6,150; working section No. 1, including 14 lock gates, woodwork for sluice gates, lumber foundations, sheet piling, stonework, concrete, iron for excavation and sluice gates and paving, Carmichael & Co., Akron, $16,952; working section No. 2, including 16 lock gates, etc., P. J. McCourt, Akron, $20,035; working section No. 3, including 12 lock gates, etc., McGarry & McGowan, Akron, $17,443; to the same contractors for general work on locks, $4,180, and for protection stone, $7,500. In addition, the board provided for work to the value of $10,000 to be done by its own employes.

Bids will be received by the Bd. of Pub. Service, Mar. 15 for 6,000 street signs in place,, as advertised in The Engineering Record.

Dayton, O.—Bids are wanted Mar. 9 for furnishing material and constructing a grandstand on fair grounds of Montgomery Co., said work to consist of grading, foundation and superstructure of a building, 210x68 ft.

**St. Clair, Pa.*—Wm. H. Taylor, Pres. St. Clair Coal Co., writes that the contract for 500,000 yds. of stripping (bids opened Feb. 1) has been awarded to Willard & McGraw Constr. Co., of Philadelphia.

Stevens Point, Wis.—Bids will be received May 10 by the Comrs. of Portage Co. Drainage Dist., for constructing either the whole or any one or more of ditches or lateral ditches in said Drainage District; total number of cu. yds. required, 1,310,369.99. H. Pratt, Chmn.

North Head, N. B.—It is stated that bids will be received until Mar. 4 by the Dept. of Pub. Wks., at Ottawa, Ont. (Fred Gelinas, Secy.), for constructing a breakwater and wharf here.

Manila, P. I.—Press reports state that bids will be received Mar. 10 by Col. Edwards, Ch. Bureau Insular Affairs, War Dept., Washington, D. C., for the purchase of $2,500,000 Philippine public works and improvement bonds.

**Cebu, P. I.*—The following are the bids opened on Dec. 31 by the Department of Commerce and Police, Bureau of Eng., Manila (J. W. Beasley, Consult. Engr.), for 30,000 bbls. Portland cement for use in connection with the Cebu Harbor Improvements:

Bidder and address.	*Brand and firm.*	*Price, per bbl.*
Holiday, Wise & Co., Manila	"Coloma" Rheuniche P. C. W., Cologne, Prussia	$2.49
Mitsui Bussan Kaisha, Tiago Inouya, Agent, Manila	"Onoda" Japan	2.49
Mariano Uy Chaco, Manila	"Alsen," Alsen'sche P. C. Fabriken, Hamburg	2.57
Froelich & Kuttner, Manila	"Saturn," P. C. F. Saturn, Hamburg	2,6975
Henry W. Peabody & Co., Manila	"Atlas," Atlas Portland Cement Co., U. S. A.	2.87
Behn Myer & Co., Manila	"Hemmoor," "Breitenberg," Breitenberger P.C. Works, Salder. "Saturn"	2.58 and 2.53 2.40
Alsen'sche Portland Cement Fabriken, Hamburg (awarded contract)	"Alsen," Hamburg	2.27
W. H. Anderson & Co., Manila	"Emerald," Green Island Cmt. Co., Hong Kong	2,295
J. G. White & Co., Manila	"Germania," P. C. F. Germania, Lehrte, Prussia	2.60

PROPOSALS OPEN.

For proposals see pages 24, 25, 26, 27 and 28.

WATER WORKS.

Bids Close.		See Eng. Record.
Feb. 28.	Waterman, Ill.	Feb. 18
Feb. 28.	Meters, etc., Memphis, Tenn.	Feb. 25
Mar. 1.	Medina, N. Y. Adv. Feb. 18, 25.	Feb. 18
Mar. 1.	**Graham, N. C.**	**Feb. 11**
Mar. 1.	**Charton, Ia.**	**Jan. 28**
Mar. 2.	Pipe, Bellingham, Wash.	Feb. 25
Mar. 3.	Pipe, Youngstown, O.	Feb. 18
Mar. 3.	Hydrants, Youngstown, O.	Feb. 18
Mar. 3.	Valve boxes, Youngstown, O.	Feb. 18
Mar. 3.	Meters, Youngstown, O.	Feb. 18
Mar. 3.	Valves, Youngstown, O.	Feb. 18
Mar. 3	**Tank, etc., Ft. Reno, Okla. Ter.**	**Feb. 11**
Mar. 4.	Main, Seattle, Wash.	Feb. 25
Mar. 4.	Pipe, Cleveland, Miss.	Feb. 25
Mar. 4.	Hydrants, etc., Chicago, Ill.	Feb. 25
Mar. 4.	Meeker, Colo. Adv. Feb. 18, 25.	Feb. 4
Mar. 4.	**Meeker, Colo., Adv. Feb. 18.**	**Feb. 4**
Mar. 6.	Pump and boiler, Santa Ana, Cal.	Feb. 25
Mar. 6.	Ford City, Pa. Adv. Feb. 11 to 25.	Feb. 11
Mar. 6.	Pumping plant, Iowa Falls, Ia. Adv. Feb. 18, 25.	Feb. 18
Mar. 7.	Milwaukee, Wis.	Feb. 25
Mar. 7.	Pipe, Ft. D. A. Russell, Wyo.	Feb. 25
Mar. 8.	Hydrants, etc., New York, N.Y.	Feb. 25
Mar. 8.	**Mains, Ft. DuPont, Del.** Adv. Feb. 11 to 25.	**Feb. 11**
Mar. 8.	Filtration, Pittsburg, Pa. Adv. Jan. 28 to Feb. 25.	Jan. 28
Mar. 10.	Bishop, Cal.	Feb. 18
Mar. 11.	Basin, Lorain, O.	Feb. 18
Mar. 13.	Pipe fittings, etc., Winnipeg, Man., Adv. Feb. 25	Feb. 25
Mar. 13.	Stop-cock boxes, Cleveland. O. Adv. Feb. 25.	Feb. 25
Mar. 14.	Pipe, etc., Cincinnati, O.	Feb. 25
Mar. 15.	Tank, Osborne, Kan.	Feb. 25
Mar. 16.	Callicoon Depot, N. Y.	Feb. 25
Mar. 17.	Pipe and cstgs, Cincinnati O. Adv. Feb. 18, 25.	Feb. 18
Mar. 20.	North Bay, Ont.	Feb. 25
Mar. 20.	Boyce, La., Adv. Feb. 25	Feb. 25
Mar. 21.	Engine, Toronto, Ont. Adv. Feb. 25.	Feb. 25
Mar. 21.	Well, Ft. Caswell, N. C. Adv. Feb. 4 to 18.	Feb. 4
Mar.31.	**Meters, Pocatello, Idaho.** Adv. Jan. 28 to Feb. 18.	**Jan. 28**
Mar. —.	Sylacauga, Ala.	Feb. 28
Mar. —.	Smith's Grove, Ky	Jan. 7
Apr. 1.	**Irrig., Usk, Wash**	Dec. 24
Apr. 10.	Main supply canal, Belle Fourche, S. D. Adv. Feb. 18, 25.	Feb. 18
Apr. 10.	Pipe & Spcls, Winnipeg, Man. Adv. Feb. 18.	Feb. 18
Apr. 18.	New Orleans, La. Adv. Feb. 11 to 25.	Feb. 11
Apr. 25.	Canal, pipe, etc., N.. Orleans, La. Adv. Feb. 18, 25.	Feb. 18
May. 1.	**Shirley, Ind.**	**Feb. 11**
Mar. 22.	Providence, R. I. (2 prop) Adv. Feb. 18, 25.	Feb. 18
Mar. 23.	Washington, D. C. Adv. Feb. 25.	Feb. 25
Mar. 25.	Bentonville, Ark.	Feb. 25
Mar. 30.	Manistee, Mich.	Feb. 25
Apr. 4.	Alma, Neb.	Feb. 18
Apr. 4.	**Goldendale, Wash**	**Feb. 11**
Apr. 6.	Wabash, Ind.	Feb. 25

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Feb. 27.	Cincinnati, O.	Feb. 25
Feb. 27.	Lansing, Mich.	Feb. 25
Mar. 1.	Ft. Collins, Colo	Feb. 25
Mar. 1.	Norristown, Pa.	Feb. 18
Mar. 1.	Brooklyn, N. Y.	Feb. 18
Mar. 1.	Brandon, Man. Adv. Feb. 18, 25.	Feb. 18
Mar. 2.	Buffalo, N. Y.	Feb. 25
Mar. 2.	Cleveland, O.	Feb. 25
Mar. 3.	Milwaukee, Wis.	Feb. 25
Mar. 6.	Montgomery, Ala.	Feb. 25
Mar. 6.	Atlanta, Ga.	Feb. 18
Mar. 6.	**Washington, D. C.** **Adv. Feb. 11.**	**Feb. 11**
Mar. 7.	Holly Springs, Miss. Adv. Feb. 18.	Feb. 18
Mar. 8.	Columbus, O., Adv. Feb. 25.	Feb. 25
Mar. 10.	Bishop, Cal.	Feb. 18
Mar. 11.	Des Moines, Ia. Adv. Feb. 25.	Feb. 25
Mar. 11.	Lorain, O.	Feb. 18
Apr. 18.	New Orleans, La. Adv. Feb. 11, 18.	Feb. 18
Mar. 20.	North Bay, Ont.	Feb. 25

BRIDGES.

Bids Close.		See Eng. Record.
Mar. 1.	Linneus, Mo.	Feb. 25
Mar. 1.	Klamath Falls, Ore.	Feb. 25
Mar. 1.	Columbus, Neb.	Feb. 25
Mar. 1.	Tombstone, Ariz.	Feb. 18
Mar. 1.	**South Bend, Ind.**	**Jan. 28**
Mar. 2.	New York, N. Y.	Feb. 25
Mar. 3.	Kalama, Wash.	Feb. 25
Mar. 4.	**Valley City, N. D.**	**Feb. 11**
Mar. 6.	St. Anthony, Idaho	Feb. 25
Mar. 6.	Mt. Vernon, Ind.	Feb. 25
Mar. 6.	Minneapolis, Minn.	Feb. 25
Mar. 6.	West Point, Miss.	Feb. 25
Mar. 6.	Yazoo City, Mis.	Feb. 25
Mar. 6.	Valparaiso, Ind.	Feb. 18
Mar. 6.	**Amite City, La.**	**Feb. 11**
Mar. 6.	San Jose, Cal.	Feb. 4
Mar. 7.	Albion, Ind.	Feb. 25
Mar. 8.	Des Moines, Ia.	Feb. 25
Mar. 13.	**San Bernardino, Cal**	**Feb. 11**
Mar. 15.	Crawfordsville, Ind.	Feb. 25

PAVING AND ROADMAKING.

Bids Close.		See Eng. Record.
Feb. 27.	Jersey City.	Feb. 25
Feb. 27.	Cincinnati, O.	Feb. 25
Feb. 27.	San Antonio, Tex.	Feb. 25
Feb. 27.	Wilkesbarre, Pa. Adv. Feb. 4 to 18.	Feb. 4
Feb. 27.	Hartford, Conn. Adv. Jan. 28, Feb. 4.	Jan. 28
Feb. 28.	Des Moines, Ia.	Feb. 25
Feb. 28.	Des Moines, Ia.	Feb. 18
Feb. 28.	New York, N. Y.	Feb. 18
Feb. 28.	Toledo, O.	Feb. 18
Mar. 1.	Indianapolis, Ind.	Feb. 18
Mar. 1.	**Grass Valley, Cal.**	**Jan. 28**
Mar. 2.	Toledo, O.	Feb. 25
Mar. 3.	**Cincinnati, O.**	**Feb. 11**
Mar. 4.	Seattle, Wash.	Feb. 25
Mar. 6.	Ashland, Ky.	Feb. 25
Mar. 7.	St. Louis, Mo.	Feb. 25
Mar. 7.	Bucyrus, O.	Feb. 25
Mar. 7.	Rockville, Ind.	Feb. 18
Mar. 7.	**Broad Ripple, Ind.**	**Feb. 11**
Mar. 8.	Brooklyn, N. Y.	Feb. 25
Mar. 10.	Cincinnati, O.	Feb. 18
Mar. 13.	Bedford, Ind.	Feb. 18
Mar. 14.	Cambridge, O., Adv. Feb. 25	Feb. 25
Mar. 15.	Rensselaer, Ind.	Feb. 25
Mar. 15.	Elizabeth, N. J.	Feb. 25
Mar. 16.	Bloomfield, Ind.	Feb. 18
Mar. 18.	Cincinnati, O.	Feb. 25
Apr. 18.	La Crosse, Wis.	Feb. 25

POWER, GAS AND ELECTRICITY.

Bids Close.		See Eng. Record.
Feb. 28.	Nashville, Tenn.	Feb. 25
Mar. 1.	Harlem, Mo.	Feb. 25
Mar. 1.	**Graham, N. C.**	**Feb. 11**
Mar. 3.	**Savannah, Ga.**	**Feb. 11**
Mar. 7.	Washington, D. C.	Feb. 25
Mar. 8.	Baltimore, Md.	Feb. 25
Mar. 10.	Stillman, Minn.	Feb. 18
Mar. 14.	Washington, D. C.	Feb. 18
Mar. 17.	Jefferson Barracks, Mo.	Feb. 25
Mar. 20.	**Washington, D. C.** **Adv. Feb. 11.**	**Feb. 11**
Mar. 21.	Norwalk, O., Adv. Feb. 25	Feb. 18
Ma r.25.	Portsmouth, N. H.	Feb. 25
Mar. —.	Sylacauga, Ala.	Feb. 25
Apr. 3.	Cape Charles, Va. Adv. Feb. 25.	Feb. 25
Apr. 11.	Shreveport, La.	Feb. 18
Apr. 12.	Lockport, Ill. Adv. Feb. 18.	Feb. 18
Apr. —.	**Ft. Valley, Ga.**	**Jan. 21**
May 1.	**Shirley, Ind.**	**Feb. 11**
———.	Branchville, S. C.	Feb. 18
———.	**Laconia, N. H.** **Adv. Jan. 28.**	**Jan. 28**

BUILDINGS.

Bids Close.		See Eng. Record.
Feb .27.	School, New York, N. Y.	Feb. 18
Feb. 27.	School, Castleton, S. I., N.Y.	Feb. 18
Feb. 27.	School plans, Lowell, Mass.	Feb. 18
Feb. 27.	Post Bldg., Ft. Caswell, N.C. Adv. Feb. 4 to 25.	Feb. 4
Feb. 27.	Post Bldg., Ft. Morgan, Ala. Adv. Feb. 4 to 25.	Feb. 4
Feb. 28.	School, Hilbert, Wis.	Feb. 25
Feb. 28.	Y. M. C. A. Bldg., Lawrence, Kan.	Feb. 25
Feb. 28.	Art Gallery, Toronto, Ont.	Feb. 25
Feb. 28.	**School, Storrs, Conn.**	**Feb. 18**
Feb. 28.	Court House, Des Moines, Ia.	Feb. 18
Feb. 28.	**Office Bldg., Pineridge, S. D.**	**Feb. 11**
Feb. 28.	School, Two Rivers, Wis.	Feb. 4
Feb. 28.	P. O. Bldg., Louisiana, Mo.	Jan. 21
Feb. —.	**Hospital, Albany, N. Y.**	Dec. 24
Mar. 1.	School, Germfask, Mich.	Feb. 25
Mar. 1.	Y. M. C. A. Bldg., Niagara Falls, N. Y.	Feb. 25
Mar. 1.	School, Baltimore, Md.	Feb. 25
Mar. 1.	School, Youngstown, O.	Feb. 25
Mar. 1.	School, Appleton, Minn.	Feb. 25
Mar. 1.	Theatre, Philadelphia, Pa.	Feb. 25
Mar. 1.	Church, Shamokin, Pa.	Feb. 18
Mar. 1.	**Orphanage, Jackson, Mich.**	**Feb. 18**
Mar. 1.	**School, Barrington, Ill.**	**Feb. 18**
Mar. 1.	Church plans, Portsmouth, O.	Feb. 11
Mar. 1.	**Court House, Lawrenceburg, Tenn.**	**Feb. 11**
Mar. 1.	Htg. P. O. Bldg., Hastings, Neb., Adv. Feb. 4, 11	Feb. 4
Mar. 1.	**School, Conway, S. C.**	**Feb. 11**
Mar. 1.	Court House, Edna, Tex.	Feb. 4
Mar. 1.	Htg., etc., Post Bldg., Chickamauga Park, Ga.	Feb. 4
Mar. 2.	School, Owosso, Mich.	Feb. 25
Mar. 2.	**P. O. Bldg., Adrian, Mich.**	**Jan. 28**
Mar. 3.	**Pub. Bldg., Washington, D. C.**	**Feb. 11**
Mar. 4.	School, Galt, Ont.	Feb. 25
Mar. 4.	School, Elkins Park, Pa.	Feb. 18
Mar. 4.	**School, West Des Moines, Ia.**	**Feb. 11**
Mar. 6.	Jail, Athens, O.	Feb. 25
Mar. 6.	School, New York, N. Y.	Feb. 25
Mar. 6.	Jail plans, Monticello, Miss.	Feb. 25
Mar. 6.	Town Hall, Bath, O.	Feb. 25
Mar. 6.	Annex, I. O.O.F. bldg., Springfield, O.	Feb. 18
Mar. 6.	U. S. Soldiers' Home, Washington, D. C. Adv. Feb. 4 to 25.	Feb. 4
Mar. 6.	Church plans, Portsmouth, O. **Adv. Feb. 18.**	Feb. 18
Mar. 6.	**Court House, Greenwood, Miss.**	**Jan. 28**
Mar. 6.	P. O. Bldg., Battle Creek, Mich., Adv. Jan. 21, 28.	Jan. 21
Mar. 6.	**Court House, Sardis, Miss.**	**Dec. 17**
Mar. 7.	Jail, Dublin, Ga.	Feb. 25
Mar. 7.	School Bldgs., Philadelphia, Pa.	Feb. 25
Mar. 7.	Court House, Hot Springs, Ark., Adv. Feb. 18, 25	Feb. 18
Mar. 7.	**P. O. Bldg., Findlay, O.** Adv. Jan. 21, 28.	**Jan. 21**
Mar. 8.	School, Delaware, Wis.	Feb. 25
Mar. 8.	Signal House, etc., San Francisco, Cal.	Feb. 25
Mar. 8.	Post Bldg., Ft. Baker, Cal.	Feb. 18
Mar. 8.	School, Niles, O. Adv. Feb. 18, 25.	Feb. 18
Mar. 8.	**Stone work for Pub. Bldg., Washington, D. C., Adv.** Feb. 11 to 25	Feb. 11
Mar. 8.	**Hospital, Central Islip, N. Y.**	Fe
Mar. 8.	**P. O. Bldg., Muskegon, Mich.**	Ja
Mar. 9.	School, Columbia, S. C.	Fe
Mar. 9.	School plans, Athens, Ga.	Fe
Mar. 9.	Pub. Bldg., Little Rock, Ark.	Fe
Mar. 9.	Sashes, blinds, etc., Panama	Fe
Mar. 9.	School, Jicarilla, N. Mex.	Fe
Mar. 9.	**Post Bldg., Key West Bar-**racks, Fla., Adv. Feb. 11 to 25.	Fe
Mar. 9.	Court House, Elbow Lake, Minn.	Fe
Mar. 9.	**Htg. U. S. Hospital, Sa**vannah, Ga., Adv. Feb. 11, 18.	Fe
Mar. 10.	Post Bldgs., Jefferson Barracks, Mo.	Fe
Mar. 10.	School, Freeport, Ill.	Fe
Mar. 10.	Post Bldgs., Ft. Rodman, Mass., Adv. Feb. 11 to 25	Fe
Mar. 10.	**Post Bldgs., Ft. Ontario, N.** Y., Adv. Feb. 11 to 25	Fe
Mar. 11.	Police station, Newburg Heights, O.	Fe
Mar. 11.	**Naval Prison, New York, N. Y.**	Fe
Mar. 13.	City Hall, Oskaloosa, Ia.	Fe
Mar. 13.	School, Cleveland, O.	Fe
Mar.13.	**P. O. Bldg., Hammond, Ind.** Adv. Jan. 28, Feb. 4.	Ja
Mar. 14.	Remod. Jail, Grand Forks, N. D.	Fe
Mar. 14.	**School, Kearny, N. J.**	Fe
Mar.14.	**P. O. Bldg., Moberly, Mo.** Adv. Jan. 28, Feb. 4.	Ja
Mar. 15.	School, Starbuck, Minn.	Fe
Mar. 15.	School, Chippewa Falls, Wis.	Fe
Mar. 15.	Y. M. C. A. Bldg., Seattle Wash.	Fe
Mar. 15.	Plumb. Pub. Bldg., Nat. Soldiers' Home, Va.	Fe
Mar. 15.	Church, Clyde, Kan.	Fe
Mar. 15.	**Md. Insti. plans, Baltimore, Md.**	Fe
Mar. 15.	**Univ. plans, Washington, D. C.**	Fe
Mar. 15.	Jail, Camden, N. J.	Fe
Mar. 17.	Wagon shed, Ft. Caswell, N.C. Adv. Feb. 18, 25.	Fe
Mar. 20.	School, Lascruces, N. Mex.	Fe
Mar. 20.	P. O. Bldg., Elizabeth City, N. C., Adv. Feb. 4, 11	Fe
Mar. 21.	Hospital, New York, N. Y.	Fe
Mar. 21.	Armory, Rochester, N. Y. Adv. Feb. 18, 25.	Fe
Mar. 21.	P. O. Bldg., Laredo, Tex. **Adv. Feb. 4.**	Fe
Mar. 23.	School, Baton Rouge, La.	Fe
Mar. 23.	P. O. Bldg., Sherman, Tex. **Adv. Feb. 4, 11.**	Fe
Mar. 27.	**P. O. Bldg., Lebanon, Pa.** Adv. Feb. 11, 18.	Fe
Mar. 28.	P. O. Bldg, Superior, Wis.	Fe
Mar.—.	School, Klamath Falls, Ore.	Ja
Apr. 1.	Court House, Baraboo, Wis.	Fe
Apr. 1.	Y. M. C. A. plans, Binghamton, N. Y.	Fe
Apr. 3.	Court House, Kentland, Ind.	Fe
Apr. 3.	P. O. Bldg., Macon, Ga.	Fe
Apr. 3.	Court House, Newton, Ind.	Fe
Apr. 5.	**Court House plans, New Orleans, La.**	Dec
Apr. 15.	Court House, Grundy, Va.	Fe
———.	School Bldg. material, etc., Phoenix, Ariz.	Fe
Jun. 15.	Court House plans, New Orleans, La.	Fe

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Feb. 27.	**El. Ry. franchise, Stockton, Cal.**	Ja
Feb. 28.	Elevator, Omaha, Neb.	Fe
Feb. 28.	Cars, Winnipeg, Man. Adv. Feb. 18.	Fe
Feb. 28.	**Contractors' Wagons, Panama**	Fe
Feb. 28.	**Supplies, Washington, D. C.**	Fe
Feb. 28.	**Rock Drills, Panama**	Fe
Feb. 28.	**Machine tools, Washington, D. C.**	Fe
Mar. 1.	Garb. Disp., Cleveland, O.	Fe
Mar. 1.	R. R. work, Charleston, W. Va.	Fe
Mar. 1.	Cement, Brandon, Man. Adv. Feb. 18, 25.	Fe
Mar. 1.	Island, Ellis Island, N. Y. **Adv. Feb. 4, 11.**	Fe
Mar. 2.	Plumbing material, Brooklyn, N. Y.	Fe
Mar. 2.	Iron, Brooklyn, N. Y.	Fe
Mar. 3.	**Cement, San Francisco, Cal.** Adv. Feb. 11 to 25.	Fe
Mar. 4.	Wharf, North Head, N. B.	Fe
Mar. 6.	Garbage Disposal, Long Island City, L. I., N. Y.	Fe
Mar. 6.	Dredging, Philadelphia, Pa.	Fe
Mar. 6.	Rem. wrecks, Boston, Mass.	Fe
Mar. 6.	**R. R. tunnel, New York, N. Y.**	Fe
Mar. 6.	**Drainage work, Nebraska City, Neb.**	Ja
Mar. 7.	Ditches, Storm Lake, Ia.	Fe
Mar. 8.	Cement, Brooklyn, N. Y.	Fe
Mar. 8.	Dredging plant, Detroit, Mich.	Fe
Mar. 9.	Grand stand, Dayton, O.	Fe
Mar. 9.	Steel shed, N. Orleans, La. Adv. Feb. 18, 25.	Fe
Mar. 10.	El. Ry. franchise, Oroville, Cal.	Fe
Mar. 11.	Elevators, Portsmouth, N. H.	Fe
Mar. 13.	St. Ry. franchise, Bakersfield, Cal.	Fe
Mar. 14.	Mach. tools, Washington, D. C.	Fe
Mar. 14.	Cement, Wheeling, W. Va. Adv. Feb. 18, 25.	Fe
Mar. 15.	Street Signs, Columbus, O. Adv. Feb. 25.	Fe
Mar. 15.	Cable, Washington, D. C.	Fe
Mar. 15.	El. Ry. work, Pittsfield, Mass.	Fe
Mar. 15.	Cement, Peterborough, Ont.	Fe
Mar. 15.	**Dam, etc., Los Angeles, Cal.** Adv. Jan. 21 to Feb. 18.	Ja
Mar. 17.	**Dredge, etc., St. Louis, Mo.** **Adv. Jan. 21 to Feb. 4.**	Ja
Mar. 18.	Cement, etc., Wilmington, N.C. Adv. Feb. 18, 25.	Fe
Mar. 20.	Ditch., Macon, Mo.	Fe
Mar. 20.	Levee, England, Ark.	Fe
Mar. 25.	Grading, etc., New Orleans, La.	Fe
Mar. 25.	Wharf, New Orleans, La.	Fe
Mar. 31.	**El. Ry., Shanghai, China**	Oc
———.	Hauling stone, Catskill, N. Y. Adv. Feb. 18.	Fe
Apr. 4.	Ditch, Fairmont, Minn.	Fe
Apr. 10.	**Channel work, Bermuda**	Fe
———.	**El. Ry. franchise, Yazoo City, Miss.**	Fe
May 10.	Ditch, Stevens Point, Wis.	Fe

****Items marked thus give the names of parties awarded contracts.***